BUY MORE LIBERTY BONDS

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Vol. XXXVIII
No. 13

NEW YORK, MARCH 28, 1918

Ten cents a copy
Three dollars a year

Engineering Library
APR 2 1918
UNIV. OF MICH.

Whose Fight is This?
Yours? His? Or Both?
Better Buy Another
LIBERTY BOND

THIS SPACE AND DESIGN CONTRIBUTED TO THE WINNING OF THE WAR BY Strom Bearings (Formerly U.S. Ball Bearings) U. S. BALL BEARING MANUFACTURING CO. CHICAGO ILL.

Editorial Contents, page 3

Advertisers' Index—Next to last page

JOHNSON'S RADIATOR CEMENT

Repairs Leaky Radiators Instantly

Stop Those Leaks

THE easiest and quickest way of repairing leaks in radiators, pumps, water jackets, hose connections, etc., is to use Johnson's Radiator Cement. This will stop the leaks in just a few minutes without laying up the car. No mechanical experience is required—all you have to do is to remove the cap and pour the cement into the radiator.

JOHNSON'S RADIATOR CEMENT

Johnson's Radiator Cement blends perfectly with the water until it reaches the leaks—just as soon as it comes in contact with the air it forms a hard, tough, pressure-resisting substance which is insoluble in water and consequently makes a permanent seal.

Quick—Efficient—Harmless

Johnson's Radiator Cement contains nothing which can clog or coat the cooling system. It will ordinarily seal leaks in from two to ten minutes. It requires no experience to use Johnson's Radiator Cement.—All you have to do is to remove the radiator cap and pour it in.

Quarts, $1.75 Pints, $1.00 Half-pints, $ .65

Write for our folder on "Keeping Your Car Young"—It's Free.

S. C. JOHNSON & SON, Dept. A, Racine, Wis.

AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

VOL. XXXVIII NEW YORK—THURSDAY, MARCH 28, 1918—CHICAGO NO. 13

Ford Tractor Production Plan Unchanged in Growth

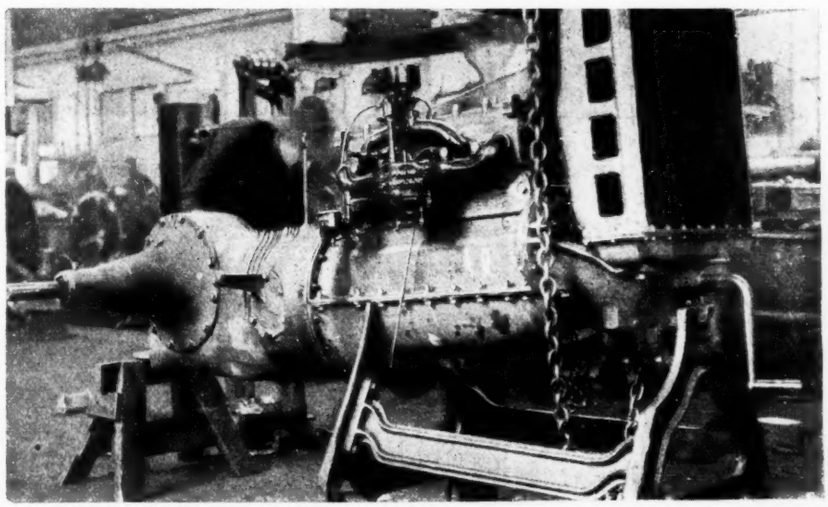
Output to Increase From Eighty-Five Per Day To Two Hundred Per Day in Three Months —Progressive Manufacture and Assembly Maintained in Spite of Rapid Growth

By J. Edward Schipper

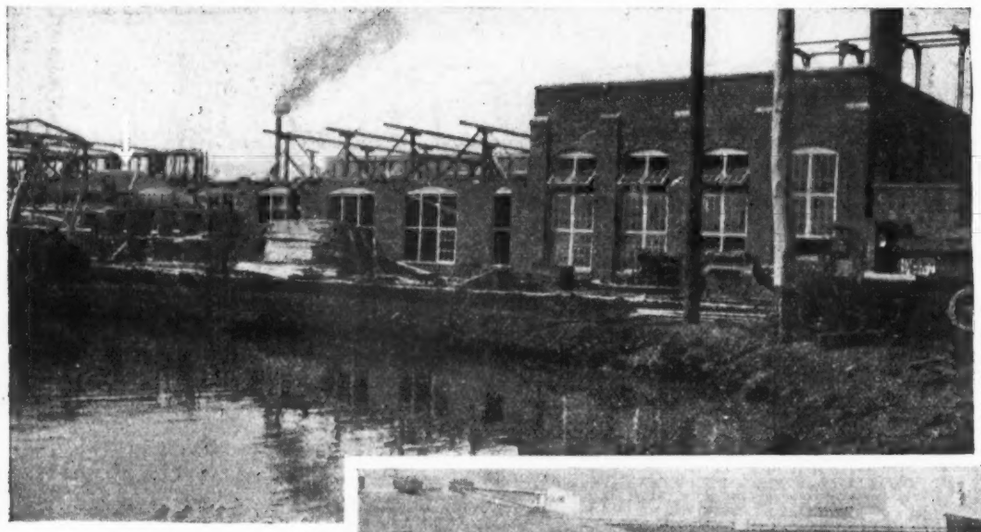
FORD tractor production at the present time is eighty per day. It is being stepped up rapidly each week, the planned schedule being eighty-five tractors daily by the end of March, 125 daily by the end of April, 150 daily by the end of May, 200 a day in June, and 300 a day by next December. This clearly represents a growing plant, and a plant which is in full production at the same time it is growing.

A story of the layout of the plant is necessarily a snapshot of a moving object. The plant does not look the same one week as it did the week before. Departments now found in one building, three weeks from now may be in a building which does not exist at the present time. Nevertheless, there is a fundamental scheme which has not been departed from with all the changing about necessary in a plant producing and growing at the same time.

Just at present a big office building, which will house all the executives, is growing up at the front end of the large, oblong plant occupied by Henry Ford & Son at Dearborn. It is growing up around the small brick building which houses the present inadequate offices. It completely surrounds this little building, but even while the structural work is going on the interior of this little building is not disturbed. Its walls remain standing and form part of the walls of the new building which is going up; that is, the little building ceases to be a building and becomes a room, and when



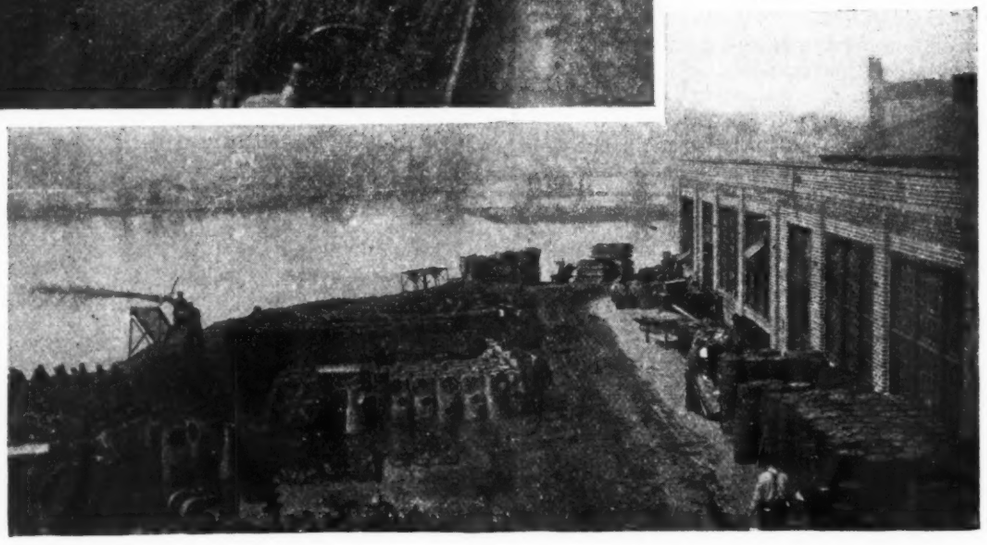
Final assembly of the tractor. This one is just about ready to receive its wheels



The new office and administrative building which is going up around the little building which formerly filled this purpose. The roof of the little building is indicated by the arrow, and when the new building is complete the roof will be lifted, leaving the interior undisturbed as a room

Bay between two of the buildings now occupied by production stock, but which will soon be roofed over to form a heat treating plant

Some of the stock necessary to maintain a steady production of eighty-five tractors per day. In 10 days an immense warehouse for storing this stock will cover this ground. The lumber for the warehouse is seen in the back ground

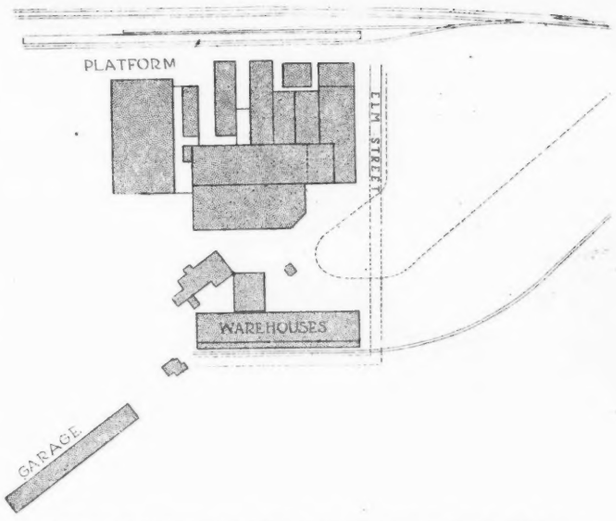


Old core sand from the foundry is being used to reclaim more land for the factory building. Some production stock and a few finished tractors which help in working around the plant are shown here on the reclaimed land

the new office building surrounding it is nearly completed, the roof will be lifted off the small building and a ceiling placed on instead, so that what now is a complete little unit in itself will become but a small part of the large administrative building.

This example of what is going on with the little office building is only a repetition of what has been taking place with whole factory departments, and yet the basic scheme of production has not been disturbed, but has, rather, been developed during the changes.

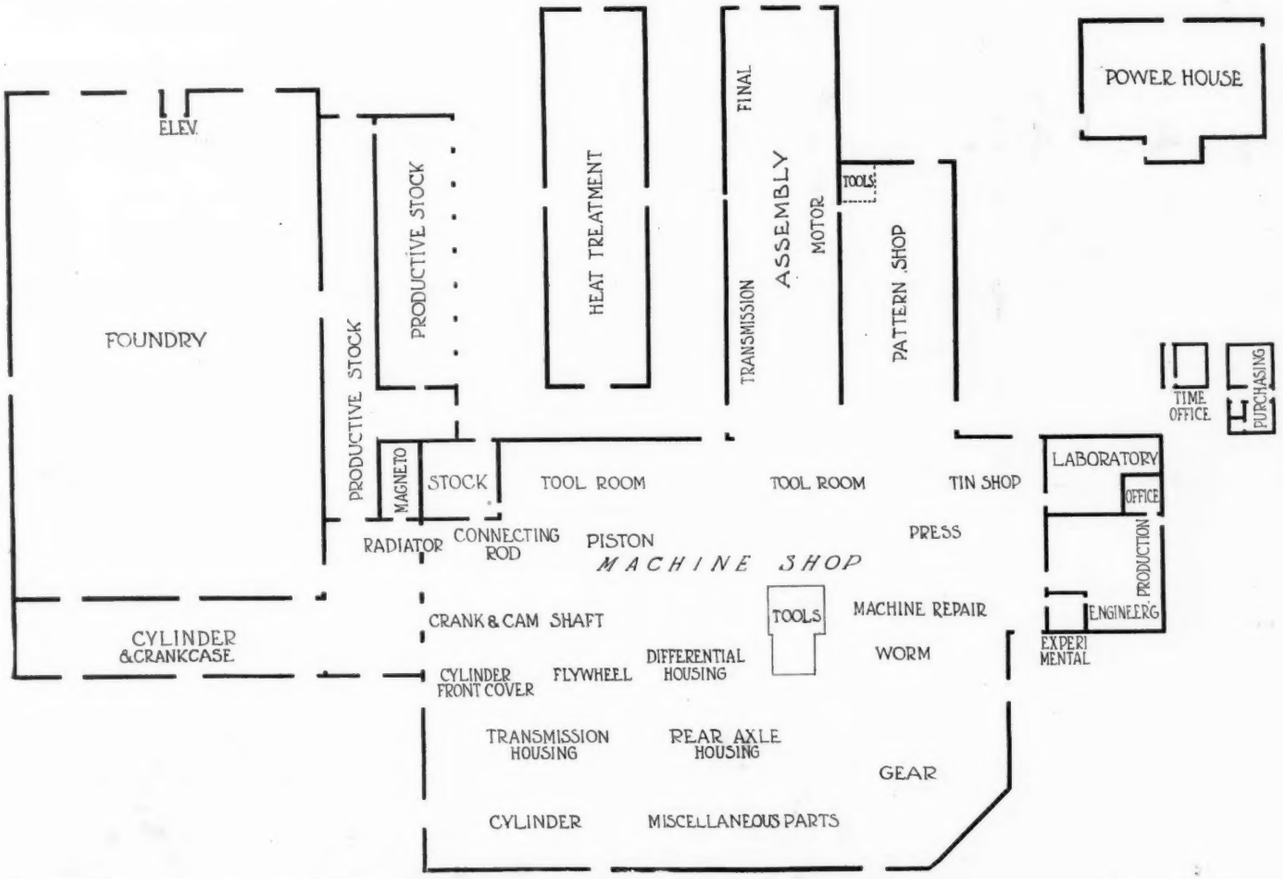
How big the plant will be when it is finally completed the officials of the company do not know at the present time, nor does Henry Ford himself. The factory will continue to grow in proportion to the demand for tractors, and as it is impossible to conceive what this demand will be, it is also impossible to conceive the future developments of the tractor plant at Dearborn. Here Henry Ford owns a tract of land of several thousand acres, a large part of which is valuable farm land, plowed, cultivated and harvested by the tractors produced in his plant on the field acreage, so that there is plenty of room for expansion.



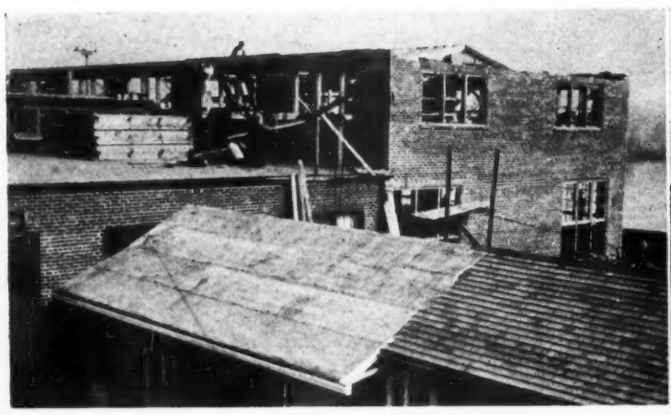
Map of buildings, loading platform and railroad sidings

The layout of the plant, as would be expected, is progressive. The elaborate conveyor systems of the Ford Motor Co., which have become famous all over the world, are missing, as the necessity of rearranging the floor space has precluded the possibility of using any elaborate conveyor system at this early date. This will come in time, but at present more elementary methods of conveying materials from one part of the plant to another are used. A large part of the work is done outside at the present time. For instance, the big castings which form the central part of the tractor and act as a housing for the gears and a part of the final drive, are made by the Ferro Machine and Foundry Co. of Cleveland; and similarly a great many other concerns contribute some of the raw and fabricated stock employed in the manufacture of the tractor. Eventually, all these parts will probably be made under the roof of Henry Ford & Son's tractor plant, and even now, in spite of the fact that production only started about the first of last September, a well-rounded-out manufacturing plant has been developed, with up-to-date methods and machines in every department.

A general layout of the plant is given in the drawing



Plan of Ford tractor factory, showing location of different departments



It took less than 3 weeks to put up the brick structure shown here. This is part of the new office building

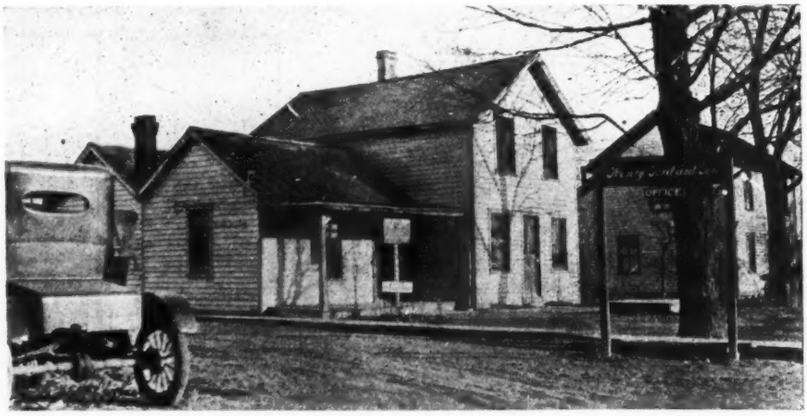
The tractors are useful in hauling the building materials through the mud roads, which would be impassable for an ordinary truck

herewith. This shows the relative positions of each of the buildings and also indicates the location of buildings now under construction and planned for the future. The drawing shows the layout of the machinery and departments of the present Ford tractor plant. The plant runs parallel to the Michigan Central Railroad tracks, which are also shown. As will be noted, there is a double siding with a dock between them, along which the plant extends. Afterward there will be other sidings brought in on the opposite side. The street marked Elm Street on the map is the only entrance. Along this street are arranged the offices, with the plant extending behind them. As the manufacturing arrangements are now laid out, the raw material works up from the back of the plant into the machine shop, which occupies one side, and from there it passes into the assembling department on the opposite side, after which it is led directly to the railroad. A large foundry building at the rear end of the factory is really the starting point of production. A great many of the castings used in the tractor are made in this foundry, and the remainder are bought outside and placed, after their arrival, into the productive stockroom, which is shown adjacent to the foundry building.

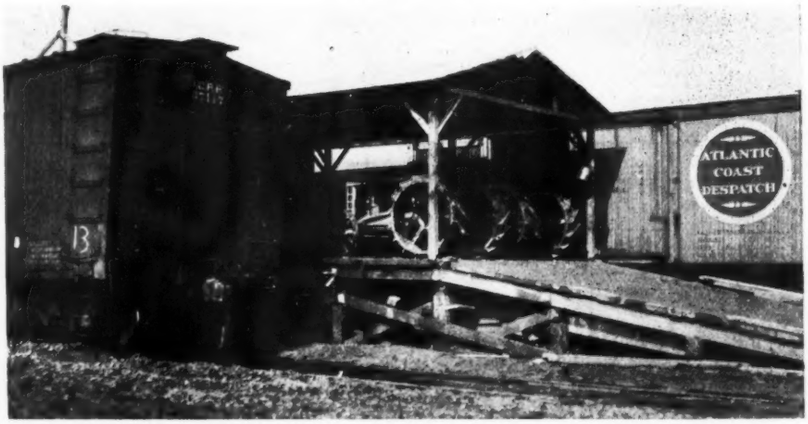
Both the castings produced in the foundry and those which come from outside plants are placed in the productive stockrooms, to be drawn upon for manufacturing purposes. Along one end of the foundry is the cylinder department, which forms the connecting link between the foundry itself and the machineshop. As the map shows, the roughing operations are carried on at the back end of the machineshop, the parts working up progressively toward the front of the buildings and then across into the motor and tractor assembly room. The cleaning operations are performed in that part of the foundry building which is adjacent to the machine-shop, and here the equipment includes snagging and disk grinders, benches, tumbling mills and the cylinder department. In the cylinder department the rough milling operations are carried on, the cylinder blocks being milled at top and bottom and both sides, the cylinder head milled off to shape, and the crankcase likewise, on heavy milling machines.

The cast top tank of the radiator and various medium-sized parts are taken care of in individual departments. It will be noted from the map that the departments are individualized throughout. There is a department for the radiators, another for connecting-rods, transmission housings, cylinders, differential housings, worm wheels, etc. These are clearly indicated on the drawing herewith, which shows the relative arrangement. The tool crib and tool-inspection department is centrally located in the machine-shop, where it is possible to supervise the tools and machinery on the entire floor.

(*Continued on page* 662)



The former administrative building for Henry Ford & Son. This is an old farm house which was converted into an office building and used up to a few weeks ago



Tractors on the loading platform, which extends the length of the plant

Further Suggestions for Selling Liberty Bonds

Hints for Going About a Liberty Bond Campaign and for Carrying Out in Detail the General Scheme Previously Described

IN carrying out the Liberty Loan Drive in an industrial plant, the benefit of co-operation of the local committee having the work in charge should always be secured. The state or city committee always has available a number of good speakers which it can furnish for this work. It would be an excellent idea for the bond sales executive to have one of these speakers come to the plant each week and make it compulsory to attend a meeting at which this speaker addresses the employees.

It does not suffice to have the men in the organization be the only ones to talk Liberty Loan to the employees. The newspapers of the city in which the plant is located should be apprised of the fact that a Liberty Loan Drive is in progress at the plant. They will be glad to get this news and will publish the results of the drive. They can

Editor's Note—Last week AUTOMOTIVE INDUSTRIES *gave an extensive outline of how to conduct a Liberty Loan campaign. In the following some further hints are given on means for carrying out this work.*

THIRD LIBERTY LOAN
DO YOUR BIT NOW!
BUY A LIBERTY LOAN BOND
GET HIS ATTENTION BY POSTERS
HOLD HIS INTEREST BY NEWS OF THE DRIVE IN THE LOCAL NEWSPAPERS
ENGAGE SPEAKERS TO EXPLAIN
MACHINE SHOP
FOUNDRY
PATTERN SHOP
STOCK ROOM
ASSEMBLING
FORGE
PAINT SHOP
BODY DEPARTMENT
OFFICE
WHERE DO YOU STAND?
BOND SALESMEN WILL ESTABLISH PERSONAL CONTACT
APPEAL TO HIS SPORTING INSTINCT BY A SALES CHART
PATRIOTIC DECORATION WILL HELP TO MAKE THE DRIVE A SUCCESS

be kept informed as to what is taking place by putting them on the list to receive the daily bulletin which should be published in accordance with the plan given in AUTOMOTIVE INDUSTRIES last week.

Throughout the factory, score boards should be displayed, telling the percentage of its quota attained by each department. It would be an excellent idea—if the departments are all equally divided—to offer a prize to the members of the winning department, that is, the department which exceeds its quota by the greatest percent. Nothing better could be found for the prize than a book of thrift stamps or a war savings certificate stamp. This would act not only as an incentive but would help swell the receipts of the Government.

If it is not possible to have a speaker address the entire organization at one time, let him divide his time so that he addresses different individuals at different times, or get two or three speakers and divide the organization up between them. There will be no difficulty in securing the speakers, as the local committees are gathering and have already gathered numbers of them to aid them in just such work.

Meeting of Committees

When the committee from the local organization calls at your plant, they will meet, if the plan is followed out, an organization which has already done the work for them. It would then be a simple matter for them to assist the factory committees to sell their own campaign, so that the industrial organization is given full credit for its work, and the employees can feel proud that they are working for a concern which has the interest of the country at heart to such an extent that it will go to the trouble to plan and carry through the drive in such a thorough manner. These are a few suggestions which will come up when the drive is being organized. If they are put into use, every employee of the factory will be approached in several different ways.

First *his eye* will perceive the posters and display cards which will be distributed all over the plant to focus his attention on the drive.

His ear will be caught by the speeches of the 4-minute men and other committee speakers that will be relied upon to a large extent to carry out this drive.

Personal contact will be established by the bond salesman who will call, not once, but many times on each person who is a prospect for the bonds, and this means practically every man and woman in the business organization.

His interest will be aroused by the daily newspaper or bulletin gotten out to spread the spirit of the drive and to indicate its progress.

His sporting instincts will be be aroused by the offer of prizes and by the friendly rivalry with other departments.

His patriotism will be appealed to by the speakers, by posters, and by the implanting of the knowledge that money alone can win the war and that the Liberty Loans are the easiest way to raise the money because they do not take anything from the pocket of the contributor that will not be repaid with full interest in due time.

Automobile Engineering Bureau of Information

COVENTRY is the largest center of the British automobile industry and occupies somewhat the same position in England as Detroit in this country. At the public libraries of such cities there naturally is a strong demand for all sorts of automobile literature, as well as scientific literature having a bearing on the construction of automobiles and parts.

A plan for collecting a comprehensive library of automobile engineering information, and to establish a sort of information bureau for the industry, has been worked out in Coventry and was described in a paper read before the Institution of Automobile Engineers recently by Ernest A. Savage, chief of the Coventry Public Libraries.

Suggestions for Collecting Automobile Literature

In outlining a scheme for collecting and classifying automobile literature the author laid it down that there should be basic books on pure science; text books of summarized practice; periodicals dealing with progressive theory and practice; matter dealing with progressive practice in small material, including trade catalogs, etc.; books on collateral subjects, and guides to literature in the form of bibliographies, indexes, abstracts and digests. Thus, it will be seen that such a Bureau of Information for the Automobile Industry must comprehend all information which can in any way be useful to the industry. The principles of collecting, in the author's opinion, were that the bureau should take into account all material which suggests new processes of manufacture, or developments of them, or gives early news of such processes which help to eliminate technical troubles in manufacturing, which indicates new uses for articles already manufactured, which makes it possible to compare specifications for raw materials and methods of testing, which describes quicker and better methods of production and organization, or which takes account of the organization and aspirations of labor, its welfare and conditions of living. Finally, some provision should be made for the study of science for its own sake. It is suggested that such a bureau should be in the hands of a man librarian with engineering knowledge, or an automobile engineer.

Conceived as a reserve bureau, such a bureau of information should possess ample resources in works of research which could not be bought by any special bureau or by any public library. This bureau should be organized, say the originators of the idea, to serve the whole industry, by forming a library of English and foreign books and periodicals —difficult to obtain when needed—of pamphlets, articles, prints, drawings, and information of all kinds. It should publish a bibliography and a periodical index to scientific literature.

The first thought that arises in connection with such a scheme is cost, but the author does not think it would be high. He contends that all the component parts of the bureau already exist in the number of very large libraries, either wholly belonging to the State or enjoying State privileges, which are not being employed to their full capacity and might reasonably be called upon to found a central bureau of information or lending library.

In support of his case, Mr. Savage quoted the International Institute of Bibliography in Brussels, founded in 1895, with the twofold aim of answering, for moderate fees, all inquiries for bibliographical information and of compiling a universal bibliography. Attached to the Institute is the International Office of Bibliography, which is responsible for a cooperative catalogue or book directory of the Belgian libraries. At the outbreak of the war, the Universal Bibliography consisted of an index of about eleven million cards. There is also the Library of the United Engineering Societies, in New York, to which is attached a bureau of information. Reference was also made to the utility of certain bureaus of commercial information on the Continent and in America in support of the scheme for a Central Industrial Information Bureau in this country, with which would work in some form not defined by Mr. Savage local bureaus in industrial centers, on the lines of that now existing at Coventry.

Electric Lighting System for U. S. A. Motorcycles

Tests Prove Possibility of Controlling Voltage Without a Battery in Circuit — Graphs Show Voltage Regulation and Relative Steadiness of Light Throughout a Wide Range of Engine Speeds

By P. M. Heldt

IN the development of the U. S. A. motorcycle it was decided to employ magneto ignition and also to fit a small electric generator for generating current for electric lighting. No storage battery is to be used, as it was feared that the motorcycle riders in the field would not be in position to give the necessary attention to the battery and that under these conditions a battery would inevitably give trouble.

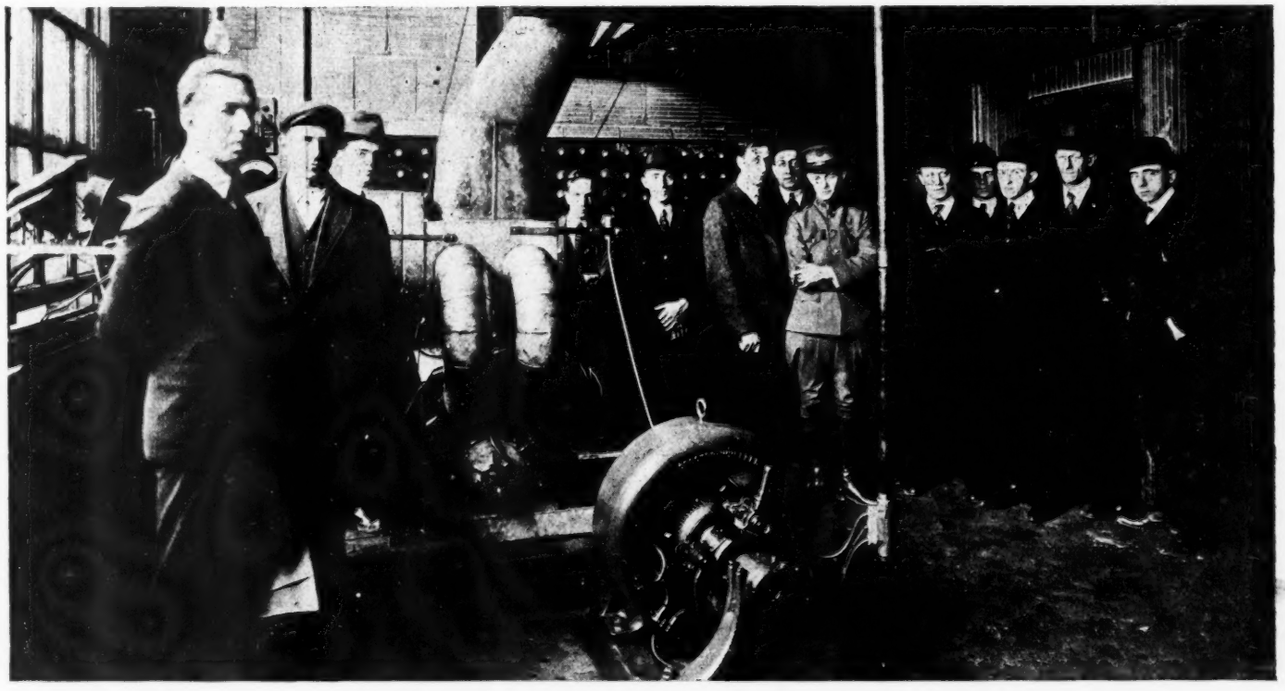
Consequently, the lights will have to be hooked up directly to the generator. Heretofore in practically all automotive electric lighting systems a storage battery has been floated on the line; such a battery has a powerful steadying influence, boosting the line voltage when the generator drops below normal speed and pulling it down when the generator exceeds this speed.

With the battery eliminated the problem of maintaining the voltage sufficiently constant so as to insure a tolerably uniform light at all engine speeds is seriously complicated. Not only must the voltage be maintained approximately constant throughout the generator speed range, but there must be no excessive flicker which might be due to the action of the voltage regulating or control device.

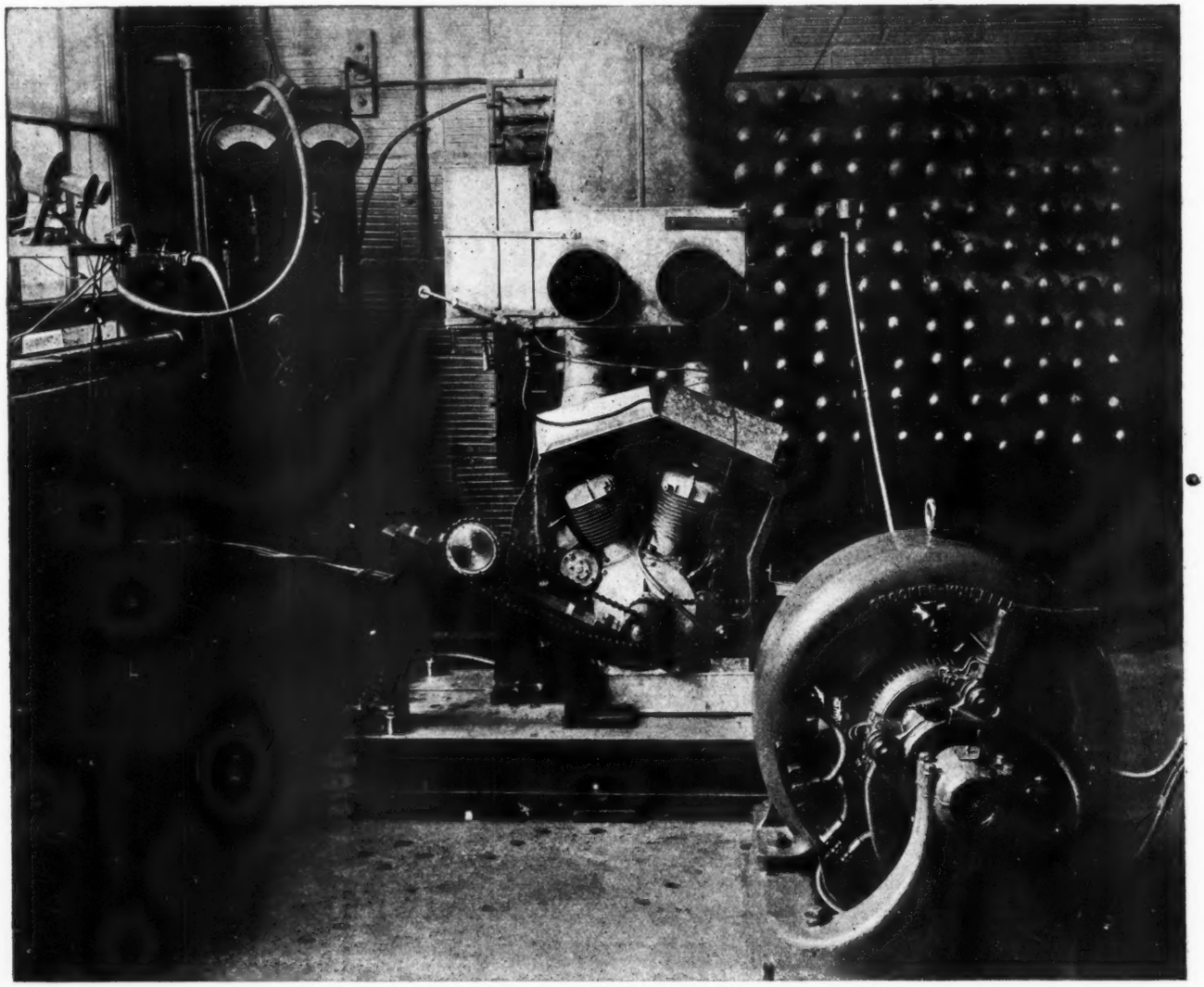
Specifications of the generator desired were drawn up by the Military Motorcycle Standardization Board and submitted to manufacturers of electrical equipment throughout the country during the latter part of January. It was stipulated that the machine must be of round section, not over 3¾ in. in diameter. It was to be clamped to a saddle cast on the crankcase, telescope into the driving gear housing and bolt against this by means of three ¼-in. 28 S. A. E. screws.

The generator was to be driven at twice crankshaft speed, was to supply current to one 15-c.p. headlamp, one 2-c.p. taillamp and one 2-c.p. side-car lamp, and its voltage must be maintained so that lamps would not blow under any circumstances. A reasonable amount of light must be given at 500 r.p.m. engine speed. Shaft and dimensions were also specified.

Four manufacturers of electrical equipment submitted



Electrical experts and members of the Military Motorcycle Standardization Committee at the tests of electric generators for the U. S. A. motorcycle



Test set-up for tests of generators for the U. S. A. motorcycle

generators for tests and had representatives on the scene when these tests were made. We will designate the four machines by the letters A, B, C, and D.

Generator A is 3 7/32 in. in diameter and weighs about 6 lb., including its control mechanism, which is inclosed within the generator housing. Control is by a regular voltage regulator, comprising a magnetic vibrator, shunt coil for operating this and a field resistance which is cut in and out by the vibrator. This regulator operates in conjunction with a third brush system. The regulator resistance is located at the commutator end of the generator under the cover. As all of the regulating devices are inside the generator and the latter is wound for a ground return wiring system, there is only a simple binding post or terminal on the outside.

A somewhat different control system is used on generator B, which is 3 7/16 in. in diameter, 6¼ in. in length over all and weighs 7¼ lb. Like type A it is of bipolar construction. The regulating mechanism comprises a vibrator with two contact points. One of these contact points is vibrated by means of a cam, or rather an eccentric on the end of the armature shaft, while the other contact point is drawn away from the vibrating one by an electromagnet energized by a coil connected across the armature. The higher the voltage generated the more the contacts are kept apart by the electromagnet and the less the field resistance is cut out. High speed of the cam also tends to reduce the time of contact and thus to keep down the voltage. This regulator is mounted on the end plate at the commutator end.

Generator C has a straight voltage control. However, the control resistance in the field circuit is divided into two parts and there is a double vibrator, so arranged that when it is actuated moderately only one contact set will open and one part of the resistance be cut into the field circuit, whereas if the actuation of the vibrator is more energetic both contact sets will open and the whole of the resistance will be cut into the field circuit. This generator is of four pole construction with series armature winding so arranged that the two brushes come on top of the commutator. The machine is 3¾ in. in diameter and weighs approximately 10 lb. with regulator.

Generator D is 3 7/16 in. in diameter and weighs 9.8 lb. It is of four-polar construction with series-wound armature, one brush being at the side and the other at the bottom. The regulator is of the usual vibrator type and is located in a circular housing on top of the generator, which can readily be removed if desired. As all of the screws holding the end plates in place are lead-sealed, the generator cannot be tampered with. The armature is coil wound and impregnated with Bakelite.

All of the generators are fitted with ball bearings. All

were successively installed on a U. S. A. cycle motor, connected to a load consisting, first, of one 12-c.p. headlamp and a 2-c.p. taillamp, then of one headlamp and one taillamp and finally of one taillamp only, and the engine with each of these loads was run at various speeds from 500 to 3600 r.p.m. At each speed ammeter readings were taken and the character of the light given out by the headlamp was noted. The ammeter hand would not stand steady but swing more or less and the extreme points reached in its swings were noted.

It may be pointed out that these tests will not be the sole basis for selecting one or more types of generator for use on Liberty motorcycles but are preliminary to extended road tests. The object was to test the generators on the engine to which they are to be fitted throughout the whole speed range and bring to the attention of the makers at the earliest possible moment any possible defects in design, so that these might be remedied before the final tests are begun. It was realized that the design of a variable speed, variable load, constant voltage generator is a comparatively new problem and that perfection would not be attained immediately. The results shown by the tests are, however, quite encouraging and there is no doubt that a thoroughly practical outfit will be secured.

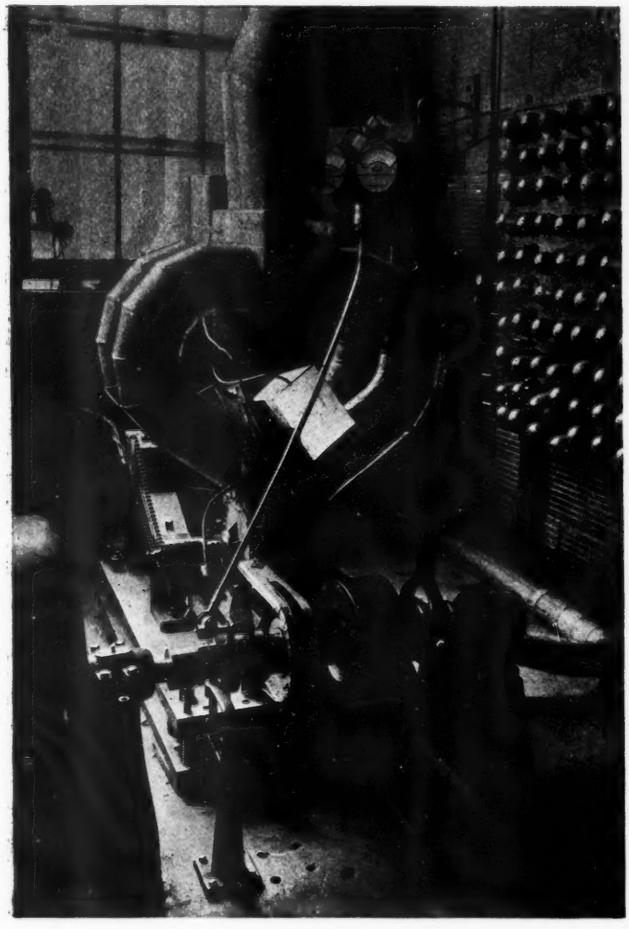
The results of the tests are given in the accompanying tables and curves. In plotting the curves the mean of any pair of voltage readings was taken. On full load very good results were obtained with three of the generators—A, B and C. Generator D, with plain vibrator voltage control, gave a rapidly increasing voltage above 2400 r.p.m. engine speed. The reason is believed to be that from about this speed the vibrator keeps the field resistance in circuit all the time so that the voltage rises with the speed.

Generators B and C also showed up well on the slightly reduced load—headlamp and one taillamp. The voltage of generator A dropped away rapidly from about 2000 r.p.m. engine speed on.

When loaded with only a single taillamp, generators B and C again maintained their voltage quite well throughout practically the whole range of engine speed. At the upper end of this range both increased considerably in voltage, that of generator C reaching 10 volts at 3600 engine r.p.m. This speed would never be attained by the engine in riding, so that this sharp rise in voltage, which is further contingent upon only a single 2-c.p. lamp being in circuit, is of little importance.

The voltage of generator A when applying only one taillamp takes a sharp upward turn at about 2000 r.p.m. engine speed, and this speed could not be much exceeded without burning out the filament. The same trouble occurred with generator D. In the case of generator A, the probable reason is that since its control is based in part on the constant current principle (third brush regulation) when the lamp load is greatly decreased too much current will flow. Generator D probably has too small a field resistance.

The above observations relate to the variation of the voltage with engine speed and generator load. Preferably this variation should be nil, but in practice such a result is unattainable. Too low a voltage, of course, means a dim light, while too high voltage means the burning out of bulbs.



Another view of the test stand

Character of Light

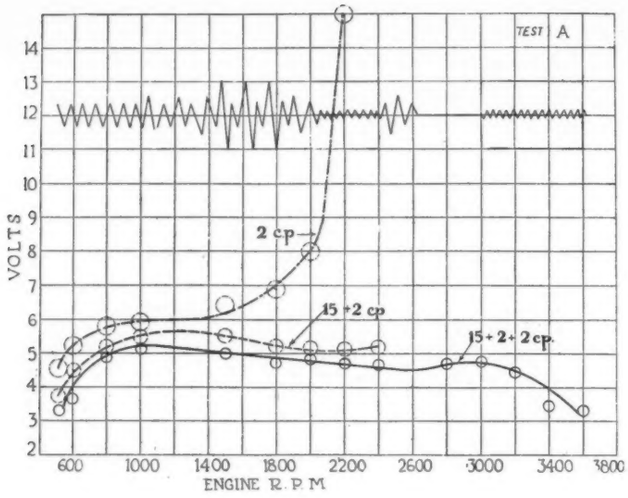
Beside the gradual variations in voltage due to variations in engine speed there are rapid variations which may result from the action of the voltage regulator or from engine vibration. Such rapid fluctuations in voltage result in a flicker or in periodic variations in the intensity of the light, which under certain circumstances may be quite annoying. As the test runs with full lamp load were made, an observer noted the character of the light given out by the headlamp, and in the diagrams the character of the light is denoted by symbols.

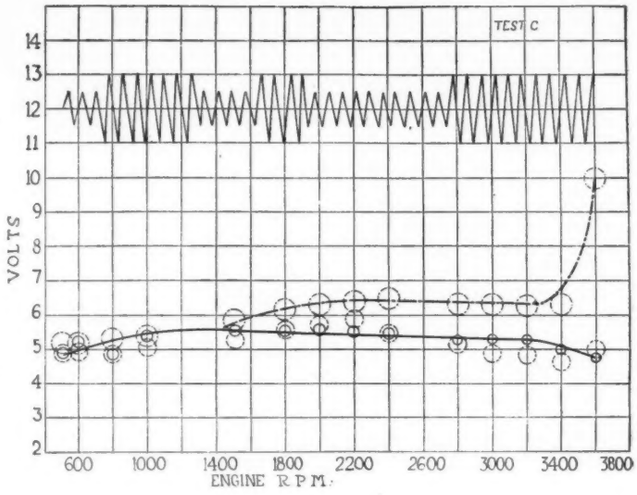
As will be seen from the illustrations, the tests were made on a test stand, the engine driving through a chain to a jackshaft to which an electric generator could be connected by means of a friction clutch.

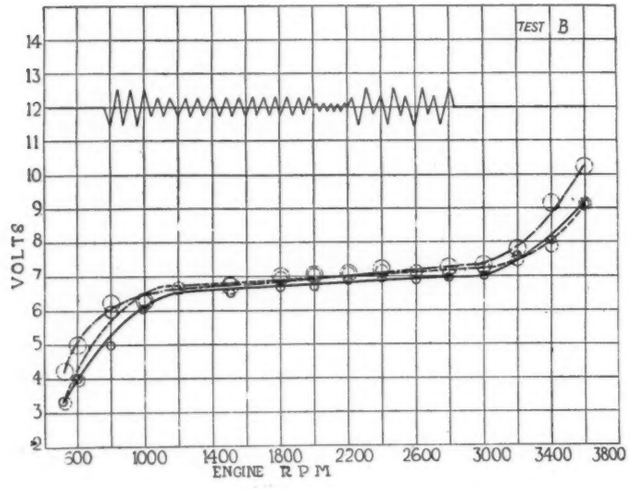
In connection with the set of curves marked D it should be pointed out that the regulator of this type generator was disabled as soon as the tests started and the representative then secured a shock regulator as used by the manufacturer on automobile equipments. The result was that regulation was rather unsatisfactory.

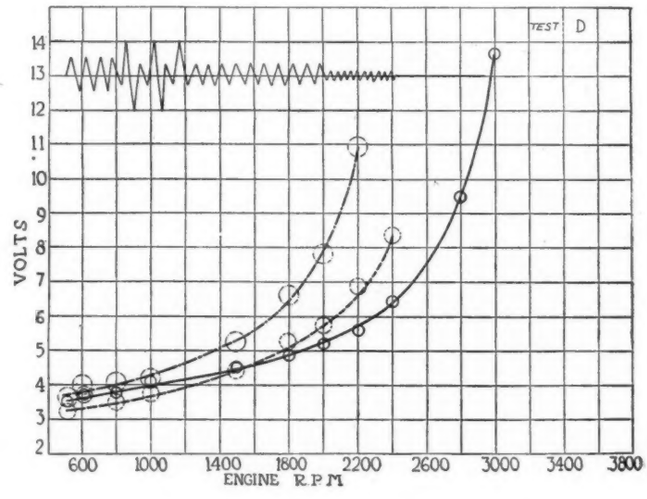
A GENERATOR—VOLTAGE READINGS

	Load		
Engine R.P.M.	15 + 2 + 2 C.P.	15 + 2 C.P.	2 C.P.
500	3.0 — 3.6	3.5 — 4.0	4.4 — 4.8
600	3.4 — 4.0	4.2 — 5.0	4.9 — 5.5
800	4.7 — 5.3	4.8 — 5.6	5.5 — 6.1
1000	4.9 — 5.4	5.0 — 6.0	5.7 — 6.2
1500	4.5 — 5.5	5.0 — 6.0	6.3 — 6.6
1800	4.4 — 5.0	4.8 — 5.6	6.8 — 7.1
2000	4.4 — 5.2	4.7 — 5.5	7.8 — 8.2
2200	4.3 — 4.9	4.5 — 5.5	15.5
2400	4.3 — 4.9	4.9 — 5.5	burned out
2800	4.5 — 4.8		
3000	4.7 — 4.9		
3200	4.2 — 4.6		
3400	3.4 — 3.7		
3600	3.2 — 3.5		









Diagrams showing results obtained from the different generators. The same kind of line represents the same load in each diagram

C GENERATOR—VOLTAGE READINGS

Engine R.P.M.	Load 15 + 2 + 2 C.P.	15 + 2 C.P.	2 C.P.
500	5.7 — 4.0	5.7 — 4.0	5.7 — 4.5
600	5.7 — 4.5	5.8 — 4.0	5.8 — 4.8
800	5.7 — 4.5	5.8 — 4.0	5.8 — 4.8
1000	5.7 — 4.5	5.7 — 4.4	5.7 — 5.0
1500	5.7 — 5.0	5.7 — 5.0	6.0 — 5.8
1800	5.8 — 5.3	5.7 — 5.4	6.1 — 6.3
2000	5.8 — 5.3	5.4 — 6.0	6.2 — 6.4
2200	5.3 — 5.8	5.7 — 6.1	6.3 — 6.5
2400	5.2 — 5.7	5.3 — 5.8	6.3 — 6.6
2800	5.0 — 5.7	4.7 — 5.6	6.0 — 6.6
3000	5.0 — 5.7	4.4 — 5.4	5.9 — 6.7
3200	5.0 — 5.7	4.3 — 5.4	5.8 — 6.7
3400	4.5 — 5.5	4.0 — 5.3	5.8 — 6.8
3600	4.2 — 5.3		

D GENERATOR—VOLTAGE READINGS

Engine R.P.M.	Load 15 + 2 + 2 C.P.	15 + 2 C.P.	2 C.P.
500	2.5 — 4.5	2.5 — 4.0	3.0 — 4.3
600	3.0 — 4.5	3.0 — 4.5	3.3 — 4.5
800	3.0 — 4.5	2.5 — 4.5	3.5 — 4.6
1000	3.5 — 4.5	3.0 — 4.5	3.5 — 4.7
1500	4.2 — 4.8	4.0 — 4.8	4.7 — 5.8
1800	4.5 — 5.3	4.7 — 5.8	6.0 — 7.2
2000	4.8 — 5.5	5.0 — 6.5	7.5 — 7.9
2200	5.2 — 6.0	6.0 — 7.8	10.7 — 11.1
2400	6.2 — 6.7	7.5 — 9.3	blew
2800	9.0 — 10.0		
3000	13.0 — 14.0		
3200	Lamp out		

B GENERATOR—VOLTAGE READINGS

Engine R.P.M.	Load 15 + 2 + 2 C.P.	15 + 2 C.P.	2 C.P.	No. Lamps*
600	4.2 — 4.1	3.9 — 4.1	4.9 — 5.1	4.7 — 4.8
800	5.0 — 5.2	5.8 — 6.2	6.0 — 6.5	6.0 — 6.5
1000	5.8 — 6.5	6.1 — 6.6	6.0 — 6.7	6.7 — 7.0
1500	6.4 — 6.6	6.4 — 6.8	6.5 — 6.9	6.8 — 7.1
1800	6.6 — 6.8	6.7 — 7.0	6.9 — 7.1	7.0 — 7.3
2000	6.7 — 6.9	6.8 — 7.1	6.9 — 7.2	7.2 — 7.4
2200	6.7 — 7.0	6.9 — 7.2	7.0 — 7.2	7.2 — 7.5
2400	6.8 — 7.1	7.0 — 7.2	7.1 — 7.3	7.2 — 7.5
2800	6.8 — 7.1	7.0 — 7.2	7.2 — 7.3	7.3 — 7.5
3000	6.9 — 7.2	7.2 — 7.4	7.3 — 7.5	7.7 — 7.7
3200	7.4 — 7.7	7.4 — 7.6	7.7 — 7.9	8.2 — 8.2
3400	8.0 — 8.3	7.8 — 8.0	9.0 — 9.2	9.5 — 9.5
3600	9.0 — 9.3	9.0 — 9.2	10.0 — 10.5	10.8 — 10.8

*This series of observations was taken specially at the request of the maker's representative.

—

THE war and the interference with international commerce which it entails has prompted every one of the large nations to make a survey of its national resources of raw materials. This is being done in England, where a national fuel has long been sought for. Now the possibility of producing lubricating oils from native materials is being discussed, and at the next meeting of the Institution of Petroleum Technologists a paper dealing with an important aspect of the subject will be read.

Traction on Bad Roads or Land*

Part III

Classification of Tracklayers—Truck Frames and Track Frame Connections—Methods of Steering Tracklayer Tractors—Power Plants

By L. A. Legros

THE various track systems may be classified as follows:

(a) Feet or sections laid by a wheel; the girdle form, of which Boydell's tractor, the ordinary girdle, and the early Pedrail, are examples.

(*b*) Chain-track supporting rollers with axes fixed relatively to the truck frame by which they are carried; examples of this are the caterpillar (Holt), Creeping-Grip (Bullock), Tracklayer (C. L. Best), Clayton, Strait, Cleveland, and others.

(*c*) Chain track supporting through secondary chains of traveling rollers arranged as intermediate chains between the truck or sledge, and the track or lag chain; examples of this are the Log-Hauler (Phoenix) steam tractor for snow and ice, the Centiped (Phoenix) tractor for soft ground, the Allis-Chalmers and the modern form of Pedrail (Diplock).

(*d*) Chain track supporting by rows of traveling balls, as in the Ball-Tread (Yuba) tractor.

Apart from the girdle, sometimes fitted to hauled vehicles, there is no modern representative of extended application of tractors of Class (*a*) known to the author.

The chain-track tractors that are constructed and used in the largest numbers, both as to makes and output, are those with rollers revolving on axes fixed to one or more truck frames for each track, Class (*b*).

It appears that chain tractors for the haulage of lumber were made and used commercially in the United States as early as 1904, and some of these early tractors are stated to have been still at work last year; these vehicles are fitted with the intermediate roller chains of Class (*c*).

Tractors in which the load is transferred from the chain to the track frame by rows of traveling balls, Class (*d*), are represented at present, so far as the author is aware, by the single example of the Ball-Tread (Yuba).

Methods of Springing

Four distinct systems of springing have been tried or are in use:

(*e*) Foot springs: In this method the springs are interposed between the actual foot and the carrying portion. Examples are the old and new forms of Pedrail (Diplock).

(*f*) Track wholly spring supported, the axle of the track frame being carried on springs: Centiped (Phoenix) and Allis-Chalmers.

(*g*) Track partly spring supported: Caterpillar (Holt), and Clayton tractor (totally over effective bearing portion).

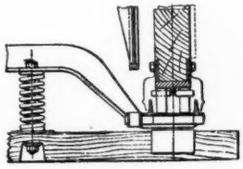
(*h*) Track pivotally sprung: Tracklayer (Best), Strait tractor (Killen-Strait), and Ball-Tread (Yuba).

Owing to many constructional difficulties direct springing of the feet, Class (*e*), has not yet taken a prominent place among commercial chain-track tractors.

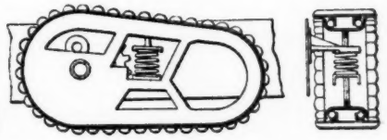
The methods of track springing are intimately associated with those adopted for insuring equable load distribution on the chain.

The method of supporting the vehicle on springs carried on the track axle, Class (*f*), requires either a chain or a cardan drive to permit driving when the springs are unequally loaded, as when crossing ditches or running on side-lying ground.

In some vehicles of Class (*g*) the whole of the effective portion of the track is capable of vertical movement, as in the Clayton tractor, in which a link connects the single truck frame to the track frame. In others the truck is in one or more parts controlled by linkwork from the back of driving-sprocket axle, a practice followed successfully by the Caterpillar (Holt).



Modern Pedrail foot and rail (Diplock)

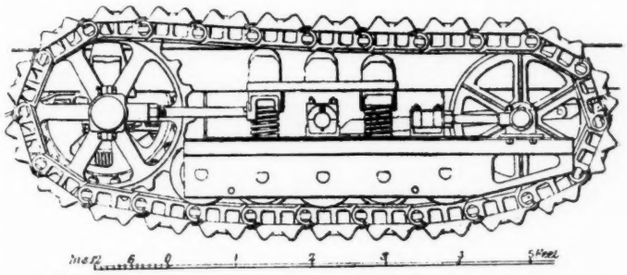


Chain track with rows of traveling balls (Yuba)

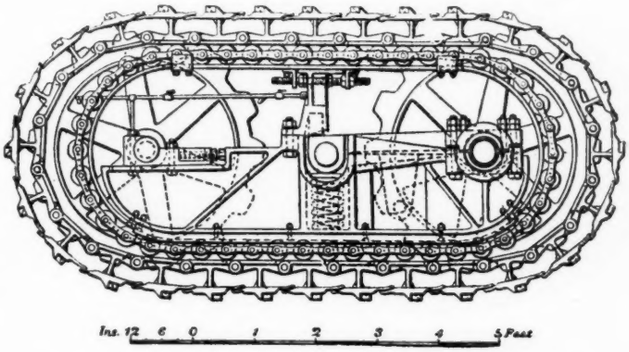
In other tractors having chain-driven sprockets the whole of the track-frame is capable of pivoting about a central axle, an arrangement which is adopted in the Creeping-Grip tractor, or the track-frame may be pivoted and sprung about the axle of the driving sprocket, as in the Tracklayer (Best), and the Strait tractor (Killen-Strait). These two arrangements, though very different in appearance, are both equivalent to partial springing of the track, Class (*h*).

The various methods adopted for distributing the load of the tractor over the chain-track elements may be classified as follows:

(*j*) Truck frame and track frame identical; this arrange-

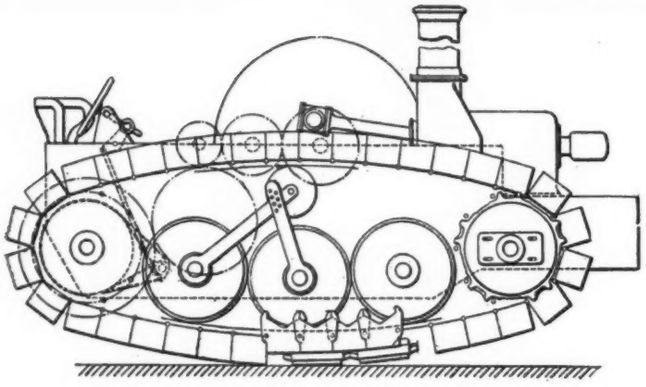


Chain track partly spring supporting (Caterpillar)

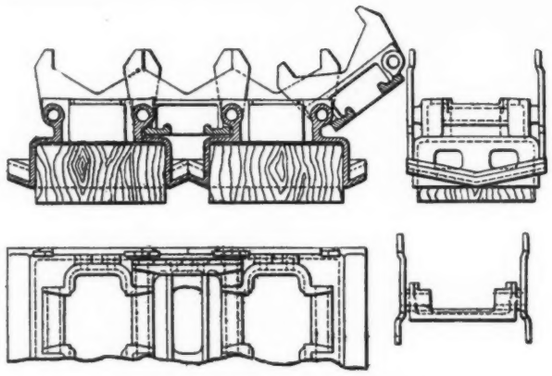


Chain track with secondary train of rollers (Centiped)

*Paper read before the Institution of Mechanical Engineers, on Friday, January 18, 1918.



Roberts tractor illustrating nut-cracker action



Details of Roberts chain track

ment is adopted in the modern form of Pedrail, in the Strait, Log-Hauler, Centiped, Allis-Chalmers, and Ball-Tread.

(*k*) Truck frame integral with track frame; this form of construction, which very closely resembles the preceding, is adopted by the Tracklayer, and Creeping-Grip.

(*l*) Truck frame in one piece connected by a link or guides to the track frame; this method is used in the Clayton tractor.

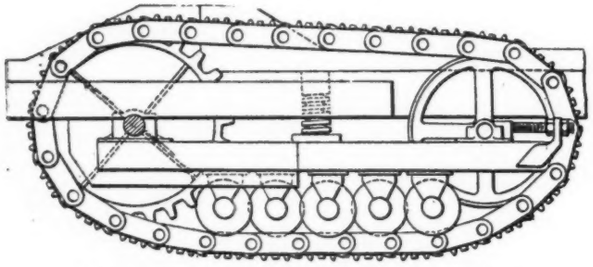
(*m*) Multiple truck frame articulated and connected by links to the track frame; this is adopted in the lower-powered Caterpillar, and enables the load on the chain track to be distributed over irregular surfaces to which the chain track and truck frames can adapt themselves under the action of the springs.

When the track frame is pivoted to the main framing, the whole length of supporting surface of the chain track is capable of adapting itself to long undulations or irregularities; this arrangement is therefore very suitable for use on ordinary ground, snow, ice, sand or marsh. The articulated truck frame, on the other hand, permits a more even distribution of load over the chain-track elements when passing over small irregularities such as stones, rocks, railway ties, rails, etc., and for this reason is better adapted for haulage from railhead into country in which rock crops out.

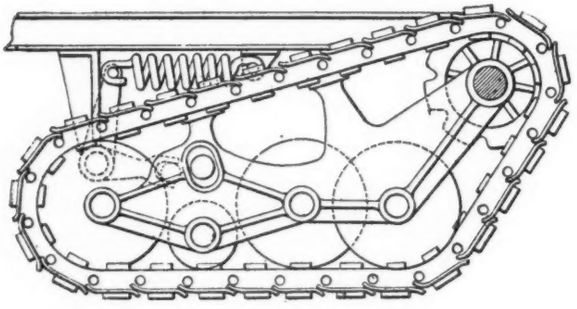
The arrangements adopted for steering vary considerably. In several models, of which the Centiped and Creeping-Grip are examples, there are steering wheels with steering of the ordinary Ackermann type; in others the practice is to use a single steering wheel, as in the Caterpillar (Holt, 75 hp.), Clayton and Ball-Tread (Yuba). The steering wheel of the Clayton is fitted with an elevating gear, so that it can be raised out of action for turning small circles. In the Strait there is a small steering chain track; in some of the lower-powered tractors—Caterpillar (Holt, 45 hp. and 18 hp.), Baby Creeping-Grip (16 hp.) and F. C. Austin (35 hp. and 15 hp.)—the tractor is carried entirely on the two tracks, and steering is effected by releasing the clutch on the inside of the curve to be taken, and driving only on the outside of the curve. In the Burford-Cleveland a brake is applied to one side and the other is driven at increased speed through the differential gear. With some tractors, the Ball-Tread (Yuba), for example, it is possible to turn the machine about its own axis, by reversing the driving direction of one of the chain tracks.

It is obvious that there are four methods available for securing steering of tractors carried on two chain tracks only; one by the use of the clutches alone; another by supplementing the clutch action by that of a brake acting on the appropriate side; a third by the use of the brake on one side and the action of a differential gear; and the operation of an independent reversing gear to each track gives a fourth method. In the majority of the designs under consideration it is possible to turn the machine in a circle of about 15 ft. to 20 ft. radius, and in some of the small tractors the turning circle is only 6 ft. radius.

In the Log-Hauler (Phoenix) steam-driven tractor, for use on snow and ice, runners are fitted for steering; these can also be arranged with some of the other types described when required to work under winter conditions.



Chain track frame with pivotal springing about rear axle



Chain track frame with pivotal springing about end bearing

Driving Gear

The drive of some tractors is fitted with a differential gear; this is usual where there is front-wheel steering, as in the Creeping-Grip or Centiped (Phoenix). In those machines in which steering is effected by declutching one or other of the tracks it is not usual to fit a differential; where, however, the steering is effected or assisted by independent clutching or braking of the tracks, as in the Clayton tractor and in the Burford-Cleveland, a differential gear is fitted to the main drive between the tracks.

The driving gear generally comprises a main clutch and a change-gear box of somewhat similar pattern to that used on motor lorries and trucks. The number of speeds fitted varies. In one instance, the Allis-Chalmers, there are four forward speeds and a reverse; in a few tractors three forward speeds and a reverse are fitted; two forward speeds and a reverse are more usual; very rarely, as in the high-power Caterpillar (Holt, 120 hp.), only a single forward speed and reverse is ordinarily fitted, the two-speed gear being an alternative arrangement.

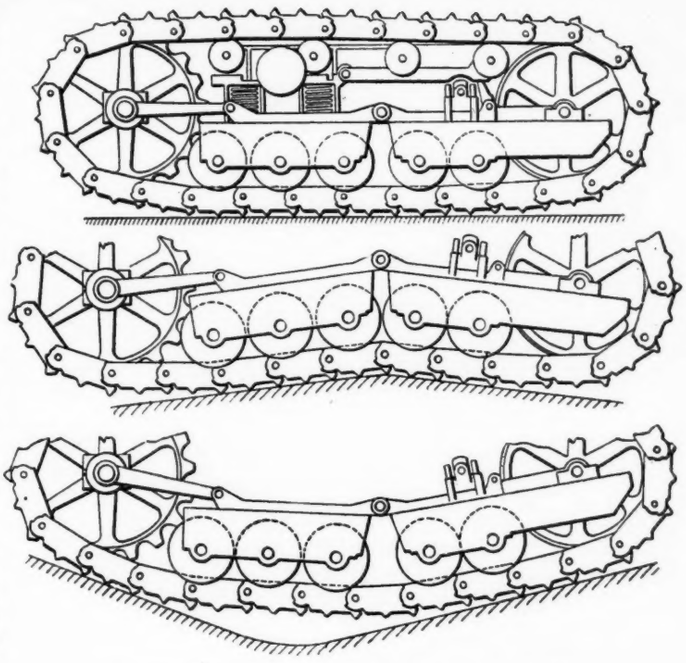
Chain Tracks

The design of the chain track itself is one of the most important factors of the success or failure of the tractor. The chain track is usually driven by a sprocket at the back end, and passes round an idler at the front carried on the track

frame and engaging only laterally with the chain track by a central flange or flanges; the idler axle is usually fitted with an adjustment for taking up wear of the chain track. It will be noted from the cross-sections shown that the width of the track is greater than the width of bearing for the rollers, and any hard object, rock or rail, encountered by the chain may therefore tend to load it unequally, and subject it to torsional stress. Furthermore, if the chain track passes over a hard and narrow object, such as a railway rail, this will tend to produce reverse curvature in any unsupported portion of the chain. This is the case where the chain has a short free length between the leading idler wheel and the first pair of carrying rollers. Realization and over-estimation of these difficulties were probably responsible for the early designs of chains made in this country. The links were so arranged that the connecting pins were raised several inches from the ground, and the blocks, of which the chain track was composed, were so made as to butt against each other when the chain track was in the position of minimum curvature. In this way the bearing portion of the chain track formed an inverted arch, which was supported at portions of its length by the rollers, and depended on contact between the links for carrying the load on intermediate portions of the chain.

In order to reduce the stresses still further, and to relieve the chain pins of the heavy load to which they would otherwise be subjected, interlocking extensions above the pins were formed on the chain links. Unfortunately this method of carrying the load resulted in the introduction of new and greater difficulties, generally known as nut-cracker action. If the track worked only on sand or mud, or even on pure clay, there would be no difficulty; but where there is a combination of stones and clay or when, in crossing gravel or roads, any hard object can be picked up by the track and get between the bearing faces of the links, the stresses so caused become excessive and the track may even become jammed. This result can be caused also by pieces of fencing wire or scrap iron such as may occasionally be picked up on a farm. In the forms of chain track now commonly used the pin centers are brought as close to the ground level as possible, and the chain plates are so formed as to shield the opening between the track plates over the working range.

The second source of trouble to which chain tracks are subject is that of stretching due to wear. This lengthens the pitch of the chain and necessitates fitting and adjusting gear to take up the slack; it also tends to cause riding on the driving sprocket. As it is usual to pitch the chain pins so widely that they will engage with alternate teeth of the driving wheel, when cut as an ordinary sprocket, this wheel should have an odd number of teeth in order to distribute the wear uniformly over the whole of the teeth.

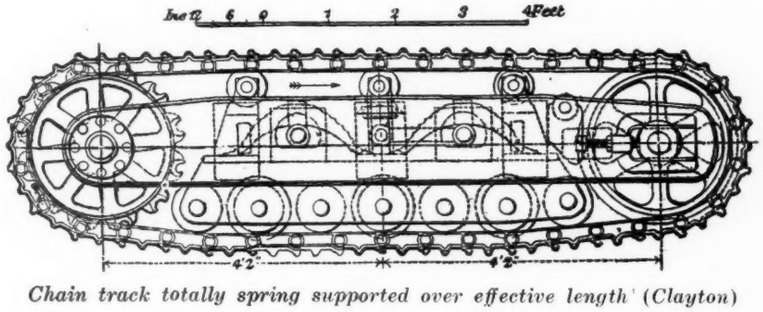


Multiple articulated truck frame (Caterpillar)

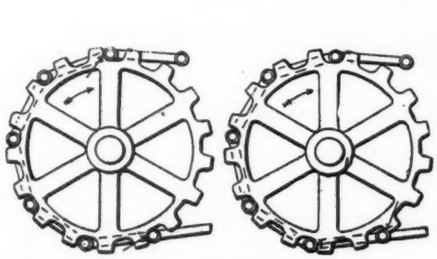
The chain-track links have three functions to perform:

1. Carrying the load.
2. Affording the necessary resistance for traction by engaging with the ground surface, and
3. Providing the gearing pin, or its equivalent in tooth form, to engage with the driving sprocket.

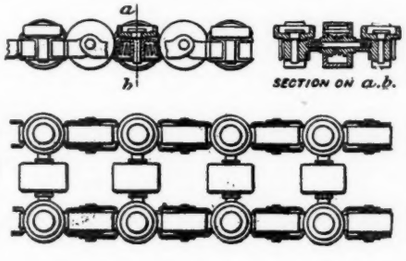
The first condition involves a machined surface, preferably hardened, for the carrying rollers to bear on. The second condition necessitates an irregular outline of the lower surface of the link, so that it can gear with the ground surface as a large pinion would gear into a rack; hence the form of shoe must approximate to a ribbed section, and is usually of pressed steel. The third condition requires that the pin joints or gear faces shall be machined accurately enough to work smoothly with the driving sprocket without risk of riding on its teeth. These three conditions, coupled with the proximity of the connecting pin to the ground, have limited the best designs to built-up forms of construction in which the actual link is a machined steel casting riveted to a pressed steel sole plate. The conditions of running require that this plate shall be of such form as to clear the end of the next plate throughout the range of inclination to which the links are subjected, and that over the same range there shall be no opening between the plates, in which nut-cracker action can take place. The troubles due to stretching can be forestalled, as was shown by Hans Renold about twenty-five years ago, by making the pitch of the driving wheel large in the first instance, so that the chain track is driven, at the beginning of its life, from a tooth nearly opposite that which is entering into engagement with it. By these means a fairly long life can be assured to the chain, provided it is not overloaded, and that efficient lubrication is maintained. The usual method is to supply a large amount of low-grade oil to the in-



Chain track totally spring supported over effective length (Clayton)



Sprocket design to allow for wear of chain (Renold)



Roller chain for Pedrail and triple roller chain

Table II—Details of Chain Track Tractors

No.	Fig.	Description	Maker	H.P.	No. of Cylinders	Bore (In.)	Stroke (In.)	Rated R.p.m.	Main Clutch	Speeds in M.P.H. at Normal Engine Revolutions				Capacity: U. S. Gallons			
										1st	2nd	3rd	Reverse	Gasoline	Kerosene	Bulk Oil	Water
1	59	Log-Hauler (steam)	Phoenix	100	4	6.25	8.0 d.a.	—*	Throttle	0	to	5.0	0 to 5.0	....	....	....	....
2	66	Centiped, 50 h.p.	Phoenix	50	4	5.5	7.0	700	.....	1.5	3.0	5.5	1.5	....	60	....	.....
3	73	Tractor-Truck, Type A	Allis-Chalmers	68	4	5.25	7.0	1,000	Cone	1.61	3.5	6.2†	1.41	25	....	....	9
4	74	Caterpillar, 120 h.p.	Holt	120	6	7.5	8.0	550	5 disc	2.13	(3.5)	...	2.13	....	65	*8.0*	80
5	75	Caterpillar, 75 h.p.	Holt	75	4	7.5	8.0	550	5 disc	2.13	3.5	...	2.13	....	65	6.0	53
6	76	Caterpillar, 45 h.p.	Holt	45	4	6.0	7.0	625	5 disc	1.5	2.13	3.5	1.5	....	43	....	8.4
7	78	Caterpillar, 18 h.p.	Holt	18	4	4.5	6.0	750	3 disc	1.5	2.2	3.6	1.5	....	14	....	5
8	92	Clayton Tractor, 110 h.p.	(Clayton and	110	6	5.75	6.5	1,000	7 disc	1.25	3.5	5.0	2.0	2.5	14	6	14
9	100	Clayton Tractor, 35 h.p.	Shuttleworth)	35	4	4.75	5.5	1,000	Cone	2.0	4.0	...	1.75	2.5	14	....	6
10	101	Tracklayer, 90 h.p.	C. L. Best	90	4	8.0	9.0	450	Expanding	1.5	2.375	....	1.625	7	79	8	32
11	....	Tracklayer, 75 h.p.	C. L. Best	75	4	7.75	9.0	450	Expanding	1.5	2.375	....	1.625	7	79	8	32
12	102	Tracklayer, 30 h.p.	C. L. Best	30	4	5.25	6.25	600	Expanding	1.75	2.5	....	2.0	....	25	1.4	.....
13	....	Tracklayer, 16 h.p.	C. L. Best	16	4	4.375	5.25	650	Expanding	1.75 to *2.38*	....	....	1.75 to *2.38*	....	15	....	.....
14	....	Creeping-Grip, "Giant"	Bullock	75	4	7.5	9.0	550	Expanding	1.06	2.4	3.4	1.77	14	52	....	60
15	107	Creeping-Grip, "Senior"	Bullock	50	4	6.5	8.0	600	Expanding	1.06	2.4	3.4	1.77	14	55	....	144
16	....	Creeping-Grip, "Junior"	Bullock	30	4	5.0	7.0	600	Expanding	2.25	4.0	....	2.25 to 4.0	14	14	....	25
17	108	Creeping-Grip, "Baby"	Bullock	16	2	6.0	6.0	550	Expanding	2.5	....	....	2.5	15	....	....	.....
18	112	Austin Tractor, No. 35	F. C. Austin	35	4	5.0	6.5	800	.....	1.25	2.5	3.75	1.25 to 3.75‡	20	40	....	56
19	113	Austin Tractor, No. 15	F. C. Austin	15	4	4.25	5.5	800	.....	1.25	2.5	3.75	1.25 to 3.75‡	9	18	....	14
20	114	Burford-Cleveland Tractor	H. G. Burford	20	4	3.5	5.125	1,000	2 disc	3.2	....	...	3.2	2.5	7	....	12
21	119	Strait Tractor	Killen-Strait	50	4	4.75	6.75	850	Cone	2.0	3.0	...	2.0	30	....	3	15
22	119	Strait Tractor	Killen-Strait	50	4	4.75	6.75	850	Cone	2.0	3.0	...	2.0	30	....	3	15
23	122	Strait Tractor, Mod. 3	Killen-Strait	25	4	4.25	5.75	900	Cone	2.25	....	....	2.25	12	....	3	8.4
24	124	Yuba Tractor, Mod. 18	Yuba Ball-tread	35	4	5.25	5.75	700	.....	1.96	3.05	...	1.96	5	27	3.8	.....
25	124	Yuba Tractor, Mod. 12	Yuba Ball-tread	25	4	4.5	5.5	700	.....	1.64	2.66	...	1.64	4	18	1.6	.....
26	137	Martin Cultivator, 25 h.p.	Martin	25	4	3.75	5.0	1,000	Cone	3.0	....	....	3.0	9	....	....	.....
27	147	Lefebvre Tractor, 40 h.p.	Lefebvre	40	4	5.125	6.25	900	Disc	2.15	2.92	...	2.15	26	....	....	10.5
28	....	Lefebvre Tractor, 30 h.p.	Lefebvre	30	4	4.375	5.125	1,000	Disc	2.15	2.92	...	2.15	26	....	....	8
29	152	Trench Excavator (steam), Mod. 60	Parsons	80	2	7.5	10.0 d.a.	175*	Expanding	0.002 to 0.045		1.5	1.5	....	....	....	204
30	153	Trench Excavator, Mod. 48	Parsons	62	4	7.25	9.0	500	Band	0.004 to 0.055		1.375	1.375	52	....	....	204
31	....	Trench Excavator, Mod. 36	Parsons	45	4	6.25	8.0	600	Band	0.004 to 0.055		1.5	1.5	46	....	....	163
32	154	Trench Excavator, Mod. 24	Parsons	30	4	5.0	7.5	650	Band	0.008 to 0.110		1.5	1.5	33	....	....	100
33	....	Trench Excavator, Mod. 18	Parsons	20	4	5.0	6.0	700	Band	0.008 to 0.110		1.5	1.5	26	....	....	47
34	....	Trench Excavator, Mod. 15	Parsons	30	4	5.0	7.5	650	Band	.....		1.5	1.5	33	....	....	100

Approximate and estimated figures are shown in italics. * Steam. † 4th speed 7.5. ‡ 3 speeds on reverse.

side of the chain; an oil drip so fitted to the side chains of certain early-pattern motor cars (1900-1902), which ran under almost identical conditions of mud and dust, has proved almost as efficient in preserving the chains as frequent removal, washing in paraffin, drying and soaking in a bath of warm tallow and plumbago. Cheap oil used lavishly appears, in fact, to keep the tracks from cutting or seizing even under very bad conditions. In the Tracklayer (Best) a different methed of providing against wear is adopted, the pin being made of rocker form.

Another matter that affects the design of the whole chain track is that of the permissible sag. The chain is supported laterally by the sprocket teeth at the back end and by the idler rim at the front end; over the intermediate parts it is only supported by the flanges of the supporting rollers. As the flanges of these rollers are limited for size by the closeness of the bearing surface to the ground, it will be seen that the permissible sag which may occur when crossing holes in rough ground is not very great. If supported at the ends the suspended portion of chain hanging freely will assume a curve which approximates to a catenary. For such a crude approximation as is afforded by the few suspended links of the chain track, the curve passing through the centers of the pins is very nearly a parabola; if the curvature is small, this in turn approaches a circular arc. The worst condition for the chain occurs when there is a combination of steering and backing on rough ground; this may at the same time cause slackness in the carrying part of the chain combined with sideway thrust due to steering, and in some of the forms of construction described the roller flanges may be caused to ride on the chain surfaces.

One method of dealing with the difficulty is that of giving a large camber to the supporting portion of the track. In a vehicle styled the "Centipede," built by William Foster & Co., Limited, the track was given a camber about equivalent to that of a 16-ft. wheel. In the majority of the tractors described the curvature of the supporting portion of the chain track is very small, corresponding to that of wheels from 90 ft. to 160 ft. in diameter, and in some cases even it has zero value, the part of the chain track on which the wheels run being laid flat. This necessitates care in keeping the chain track constantly adjusted for wear. It will be noted that this difficulty is not so serious in the chain tracks fitted with an intermediate chain, as both the chains can sag together, and it is possible to provide deep retaining faces to keep the intermediate roller chains in place.

Lateral Pressure

The lateral pressure on the chain track when the tractor is traveling on side-lying ground, or crossing ditches obliquely, is another factor that must be taken into account in designing the chain track as well as the truck frame and its connections. Under most conditions the sideway thrust is taken partly on the flanges of the truck rollers and partly on the flanges of the driving sprocket and idler. An arrangement which appears to provide specially for this condition is that of the Ball-Tread (Yuba). In this the whole of the lateral as well as the vertical pressure is transferred from the chain track to the track frame through the balls. Lateral load merely affects the angle of incidence of pressure on the ball without increase of friction. Diplock, in his recent developments of the Pedrail, has obtained the same result in a different way, by using a compound chain of rollers arranged alternately with axes horizontal and vertical, the track frame and bearing surfaces of the chain track being made with appropriate faces for receiving the vertical and lateral loads respectively.

For traveling on rough country and under general agricultural conditions the pressed steel shoe is found satisfactory. In this case the supporting surface for the rollers consists of a steel casting, or case-hardened drop-forging, bolted to the shoe; in other cases the track shoe and supporting surface

Details of Chain Track Tractors

TABLE II—(*Continued*)

Chain-Track Tractors

No.	Fig.	Description	Maker	Supports to Each Track	Track Width		Track Length	Area of Tracks		Weights (Lb.) Carried On			Total Weights (Lb.)		Insistent Weight in Lb. per Square Inch	
					Normal	Wide		Normal	Wide	Tracks		Steering Wheels				
					In.	In.	In.	Sq. In.	Sq. In.	Normal	Wide		Normal	Wide	Normal	Wide
1	59	Log-Hauler (steam)	Phoenix	14 rollers	12.0	....	60	1,440	....	30,500	.....	5,500	36,000	.....	21.18	....
2	66	Centiped, 50 h.p.	Phoenix	14 rollers	12.0	....	60	1,440	....	13,600	.....	3,200	16,800	.....	9.45	....
3	73	Tractor-Truck, Type A	Allis-Chalmers	15 rollers	12.5	....	60	1,500	....	*14,400*	.....	*3,600*	18,000	.....	*9.60*	....
4	74	Caterpillar, 120 h.p.	Holt	5 wheels	24.0	30.0	80	3,840	4,800	23,756	.....	2,500	26,250	.....	6.19	4.95
5	75	Caterpillar, 75 h.p.	Holt	5 wheels	24.0	30.0	80	3,840	4,800	21,350	.....	2,250	23,600	.....	5.56	4.45
6	76	Caterpillar, 45 h.p.	Holt	5 wheels	13.0	30.0	70	2,080	4,800	13,000	14,500	.....	13,000	14,500	6.25	3.02
7	78	Caterpillar, 18 h.p.	Holt	5 wheels	11.0	....	64	1,408	....	6,000	.....	.....	6,000	.....	4.26	....
8	92	Clayton Tractor, 110 h.p.	{Clayton and	7 wheels	22.5	....	100.5	4,522	....	26,880	.....	3,360	30,240	.....	5.94	.....
9	100	Clayton Tractor, 35 h.p.	{Shuttleworth}	4 wheels	14.0	....	71.3	2,000	....	5,040	.....	.....	5,040	.....	2.52	.....
10	101	Tracklayer, 90 h.p.	C. L. Best	7 wheels	24.0	30.0	90	4,320	5,400	*25,000*	*25,000*	*5,000*	*30,000*	*30,000*	*5.79*	*4.63*
11	...	Tracklayer, 75 h.p.	C. L. Best	5 wheels	24.0	30.0	66	3,168	3,960	*23,300*	*23,300*	*4,700*	*28,000*	*28,000*	*7.36*	*5.88*
12	102	Tracklayer, 30 h.p.	C. L. Best	4 wheels	12.0	20.0	66	1,584	2,640	8,500	8,500	.....	8,500	8,500	5.37	3.22
13	...	Tracklayer, 16 h.p.	C. L. Best	3 wheels	10.0	....	66	1,320	....	5,100	.....	.....	5,100	.....	3.86	.....
14	...	Creeping-Grip, 75 h.p.	Bullock	4 wheels	20.0	....	64	2,560	....	19,500	.....	3,500	23,000	.....	7.62	.....
15	107	Creeping-Grip, 50 h.p.	Bullock	4 wheels	20.0	....	64	2,560	....	*16,500*	.....	*3,000*	*19,500*	.....	*6.45*	.....
16	...	Creeping-Grip, 30 h.p.	Bullock	3 wheels	12.0	....	48	1,152	....	6,500	.....	*1,500*	*8,000*	.....	*5.64*	.....
17	108	Creeping-Grip, 16 h.p.	Bullock	3 wheels	12.0	....	48	1,152	....	5,200	.....	.....	5,200	.....	4.51	.....
18	112	Austin Tractor, 35 h.p.	F. C. Austin	6 wheels	12.0	36.0	96	2,300	6,900	10,800	12,300	.....	10,800	12,300	4.70	1.78
19	113	Austin Tractor, 15 h.p.	F. C. Austin	2 wheels	12.0	....	60	1,440	....	6,750	.....	.....	6,750	.....	4.70	.....
20	114	Burford-Cleveland, 20 h.p.	H. G. Burford	3 wheels	6.0	....	50	600	....	3,000	.....	.....	3,000	.....	5.00	.....
21	119	Strait Tractor, 50 h.p.	Killen-Strait	3 wheels	18.0	24.0	48	1,728	2,304	*8,000*	*8,000*	*1,500*	9,500	*9,500*	4.63	*3.47*
22	119	Strait Tractor, 50 h.p.	Killen-Strait	3 wheels	30.0	36.0	48	2,880	3,456	*8,500*	*8,500*	*1,500*	*10,000*	10,000	*2.95*	2.46
23	122	Strait Tractor, 25 h.p.	Killen-Strait	3 wheels	17.0	....	48	816	....	*5,000*	.....	*1,000*	6,000*	.....	*3.68*	.....
24	124	Yuba Tractor, 35 h.p.	Yuba Ball-tread	2x21 balls	17.0	....	48	1,632	....	7,400	.....	1,500	8,900	.....	4.53	.....
25	124	Yuba Tractor, 25 h.p.	Yuba Ball-tread	2x16 balls	15.0	....	36	1,080	....	6,000	.....	1,600	7,600	.....	5.55	.....
26	137	Martin Cultivator, 25 h.p.	Martin	3 wheels	8.0	....	40	640	....	3,250	.....	670†	3,920	.....	5.01	....
27	147	Lefebvre Tractor, 40 h.p.	Lefebvre	Not supporting	10.2	....	63	....	..	...	....	4,000	7,050	....	....	....
28	...	Lefebvre Tractor, 30 h.p.	Lefebvre	Not supporting	8.3	....	51	....	..	...	....	1,780	5,950	.....	....	....
29	152	Trench Excavator, Mod. 60	Parsons	6 wheels	26.0	....	72	3,744	....	27,000	....	27,000‡	54,000	.....	7.21	....
30	153	Trench Excavator, Mod. 48	Parsons	6 wheels	27.5	....	72	3,960	....	33,800	.....	11,200	45,000	.....	8.54	....
31	...	Trench Excavator, Mod. 36	Parsons	6 wheels	26.0	....	66	3,432	....	22,000	.....	8,000	30,000	.....	6.41	....
32	154	Trench Excavator, Mod. 24	Parsons	6 wheels	25.5	....	62	3,162	....	12,000	.....	5,000	17,000	.....	3.80	....
33	...	Trench Excavator, Mod. 18	Parsons	6 wheels	24.0	....	41	1,968	....	7,000	.....	2,600	9,600	.....	3.56	....
34	...	Trench Excavator, Mod. 15	Parsons	9 wheels	30.0	....	78	4,680	....	20,000	.....	.....	20,000	.....	4.27	.....

Approximate and estimated figures are shown in italics. *2,000 lb. on wheel. †On ploughs. ‡Two pairs of wheels.

are formed in one as a single steel casting. Where the ground surface presents small resistance to shear or actually lubricates the shoes, as is the case with clay and chalk and some grass surfaces, it is sometimes found necessary to attach grousers or spuds of angle bars to the shoes by means of bolts. When the tractor is required to do hauling on ordinary roads it may be necessary to attach thin sleepers of hard wood to the shoes in order to provide a flat bearing and prevent damage to the road surface. Those chain tracks which present fairly flat surfaces to the road and are not excessively cambered—the lower-powered Caterpillars, Clayton and Burford-Cleveland for example—can be run over inferior roads with even less risk of damage than would occur with the ordinary driving slats of the common traction engine.

Engines

The internal-combustion engines fitted to chain-track tractors are generally of a type resembling that used for heavy truck work. There is no reason for great economy in weight, and indeed the weight of the vehicle must not be too small for the tractive effort; consequently cast iron is preferred to aluminum for the engine and also for the gearbox. A governor is usually fitted to prevent racing the engine. That care which is taken in designing the passenger car engine to obtain a flat torque curve, and which is accompanied by large diameters of valves, induction and exhaust passages, is not called for here. The torque curve consequently falls rapidly at a comparatively low speed. This, as is generally recognized by the makers of engines for commercial vehicles, is not without advantage, for when the resistance to traction becomes unduly heavy, owing to gradient or softness of the ground, and the speed of the engine is consequently reduced, the torque increases and the driver has a better chance of extricating the vehicle from its difficulty without changing gear than is the case with constant torque. A typical torque curve of one of these engines is given in the accompanying diagram. The tractor engine runs at a low piston speed, 600 ft. to 900 ft. per minute; that is, at barely one-half the speed usual for the passenger car engine. On the other hand, it is required to work at a greater percentage of its full power than is the case with the passenger car engine, and for considerations of fuel economy it should, in general, be designed to give its best efficiency, measured in brake horsepower per gallon per hour, at from 50 per cent to 70 per cent of its full rated capacity. In many instances the engines are designed to start on gasoline and to run normally on kerosene, or, in America, on "distillate"; this also implies a larger engine for the power than is the case where gasoline or benzol is the usual fuel.

Lubrication

Lubrication of the engine is usually insured by the splash system, but in some instances a combined splash and forced lubrication system is fitted. Separate oil reservoirs are of course required for the engine-lubricating oil and for the crude black oil used for the track chains.

The usual form of ignition is the high-tension magneto. Self-starters are not fitted, as they would involve too much additional complication. Owing to the large size of some of these engines, and the difficulty of starting by swinging the starting crank handle, a trip gear is arranged on the magneto which enables a strong sparking current to be obtained for a small movement of the cranking handle. This arrangement was used by the author in 1895 on gas-traction tram cars, the engines of which were started by pulling over the flywheel. The combined use of gasoline for starting and kerosene for running complicates the carbureter and piping arrangements slightly, and involves fitting an extra tank,

Details of Chain Track Tractors

TABLE II—(*Concluded*)

No.	Fig.	Description	Maker	Steering Gear	Tractor Overall: Normal Width	Tractor Overall: Length	Turning Radius	Drawbar Pull on Low Gear	Front Wheels: No.	Front Wheels: Width	Front Wheels: Diam.	Pitch of Chain Track	Drawbar Pull Per Cent of Weight: Normal	Drawbar Pull Per Cent of Weight: Wide
					Ft. In.	Ft. In.	Ft. In.	Lb.		In.	In.	In.		
1	59	Log-Hauler (steam)	Phoenix	Runners and engines	5 4	27 6	75 0	.....	2	Runners		*9.5*	....	....
2	66	Centiped, 50 h.p.	Phoenix	Front wheels	5 4	21 0	25 0	8,000	2	10	40	*9.5*	47.6	....
3	73	Tractor-Truck, Type A	Allis-Chalmers	Front wheels	*5 6*	*21 6*	*26 0*	8,000	2	10	40	7.6	44.4	....
4	74	Caterpillar, 120 h.p.	Holt	Front wheel and clutches	8 8	21 0	*16 0*	12,000	1	18	36	*9.25*	45.7	....
5	75	Caterpillar, 75 h.p.	Holt	Front wheel and clutches	8 8	19 6	15 0	8,500	1	18	36	*9.25*	36.0	....
6	76	Caterpillar, 45 h.p.	Holt	Clutches and brakes	6 8	12 9	6 0	4,500	None	....	....	*9.25*	34.6	31.0
7	78	Caterpillar, 18 h.p.	Holt	Clutches	4 3	9 6	6 0	2,800	None	....	.....	*7.5*	46.7	....
8	92	Clayton Tractor, 110 h.p.	Clayton and Shuttleworth	Front wheel and brakes	7 4	17 6	10 0	22,000	1	6	50	7.75	72.8	....
9	100	Clayton Tractor, 35 h.p.	Clayton and Shuttleworth	Clutches and brakes	5 4	10 10	7 0	.....	None	.....	.....	7.5	....	....
10	101	Tracklayer, 90 h.p.	C. L. Best	Front wheel and clutches	*8 9*	*24 6*	....	14,500	1	20	40	9.75	48.3	....
11	...	Tracklayer, 75 h.p.	C. L. Best	Front wheel	8 7	22 4	.....	12,000	1	24	48	9.75	42.9	....
12	102	Tracklayer, 30 h.p.	C. L. Best	Clutches and brakes	5 5	9 4	6 0	3,500	None	....	.....	7.25	41.2	....
13	...	Tracklayer, 16 h.p.	C. L. Best	Clutches and brakes	4 2	7 0	5 0	1,750	None	....	.....	4.6	34.3	....
14	...	Creeping-Grip, 75 h.p.	Bullock	Front wheels	8 0	18 8	30 0	13,000	2	10	40	9.0	56.5	....
15	107	Creeping-Grip, 50 h.p.	Bullock	Front wheels	8 0	18 0	30 0	8,200	2	10	40	*9.0*	42.1	....
16	...	Creeping-Grip, 30 h.p.	Bullock	Front wheel	5 8	13 0	22 0	3,330	1	14	32	*7.0*	41.6	....
17	108	Creeping-Grip, 16 h.p.	Bullock	Clutches*	5 3	11 6	8 0	.....	None	....	.....	*6.0*	*30.6*	....
18	112	Austin Tractor, 35 h.p.	F. C. Austin	Clutches and brakes	5 8	10 0	6 0	5,400	None	....	.....	*9.0*	50.0	43.9
19	113	Austin Tractor, 15 h.p.	F. C. Austin	Clutches and brakes	6 0	9 0	6 0	3,000	None	....	.....	*9.0*	44.4	....
20	114	Burford-Cleveland, 20 h.p.	H. G. Burford	Band brakes	4 2	8 0	6 0	*2,000*	None	....	.....	8.0	*66.7*	....
21	119	Strait Tractor, 50 h.p.	Killen-Strait	Front track	6 0	13 0	8 0	5,600	1	14	chain	6.5	59.0	*59.0*
22	119	Strait Tractor, 50 h.p.	Killen-Strait	Front track	8 0	13 0	8 0	5,600	1	14	chain	6.5	*56.0*	56.0
23	122	Strait Tractor, 25 h.p.	Killen-Strait	Front track	5 10	12 10	8 0	*2,500*	1	12	track	6.5	41.7	....
24	124	Yuba Tractor, 35 h.p.	Yuba Ball-tread	Front wheel*	6 1	15 1	7 6	4,600	1	14	36	*3.75*	51.7	....
25	124	Yuba Tractor, 25 h.p.	Yuba Ball-tread	Front wheel*	5 9	14 7	7 9	3,400	1	14	36	*3.75*	44.7	....
26	137	Martin Cultivator, 25 h.p.	Martin	Dog clutches	4 6	16 0†	8 0	*1,900*	None	....	.....	7.0	48.5	....
27	147	Lefebvre Tractor, 40 h.p.	Lefebvre	Front wheels	6 1	18 0	16 6	4,400	2	10	30	8.5	62.4	....
28	...	Lefebvre Tractor, 30 h.p.	Lefebvre	Front wheel	5 9	15 8	11 6	3,100	1	14	30	8.5	52.0	....
29	152	Trench Excavator, Mod. 60	Parsons	Front and back wheels	10 0	35 0	30 0	.....	2‡	14	40	7.0	....	....
30	153	Trench Excavator, Mod. 48	Parsons	Front wheels	10 5	46 6	50 0	.....	2	20	40	6.0	....	....
31	...	Trench Excavator, Mod. 36	Parsons	Front wheels	8 9	36 6	50 0	.....	2	20	34	6.0	....	....
32	154	Trench Excavator, Mod. 24	Parsons	Front wheels	7 8	28 3	30 0	.....	2	15	30	6.0	....	....
33	...	Trench Excavator, Mod. 18	Parsons	Front wheels	7 0	23 0	30 0	.....	2	15	26	5.0	....	....
34	...	Trench Excavator, Mod. 15	Parsons	Clutches	10 0	15 0	30 0	....	None	....	.....	6.0	....	....

Approximated and estimated figures in italics. *Either track can be reversed. †Includes ploughs. ‡Also two back wheels.

but the advantage of ease in starting is well worth this.

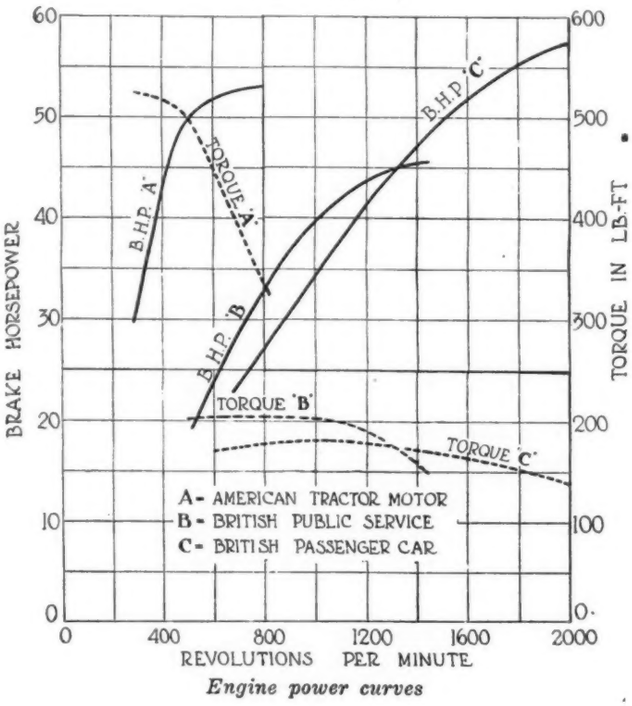
The radiators of chain-track tractors have been designed to meet the exigencies of the working conditions. The cooling surface must be large to enable the engine to run continuously under heavy load in the heat of summer; and a fan, if fitted, must be easy of access and simple in its driving gear. The water supply carried must be sufficiently large to last for a long journey of perhaps a whole day away from the base station; for this reason a large tank for water, or equivalent radiator capacity, is provided in most models. Finally, it is necessary that the whole water system should be capable of being drained at its lowest points, to avoid risk of damage by frost when the machine is laid up in winter.

As the machines have to work in places distant from large manufacturing centers, it is moreover advisable that the design of radiator should admit of its easy removal from the vehicle, of ready access of its water joints, and of the possibility of executing repairs without special tools and appliances. The conditions of the problem are similar to those of the motor omnibus; more severe regarding the total cooling to be effected, and less severe in weight restrictions. The type generally adopted is the vertical gilled tube with top and bottom reservoirs; in some of the lower-powered tractors these reservoirs are made of sufficient size to avoid fitting a separate water tank. The water circulation is usually forced by means of a centrifugal pump or by a gear pump, the former type being the more common.

At normal revolutions per minute of the engine the lowest or first speed of the majority of chain-track tractors varies from 1.25 m.p.h. to 2.25 m.p.h.; on the second speed from 2 m.p.h. to 3.5 m.p.h.; and on the third or top speed, where such is fitted, from 3 m.p.h. to 5.5 m.p.h.

The changing of gear is usually effected by sliding gears or dog-clutches in a gearbox of motor-lorry type, the main clutch being disengaged for gear changing or reversing. Cut steel gears, case-hardened, are usual for spurs and bevels; plain bearings are commonly fitted in the gearboxes, which are of heavy design and usually of cast-iron.

(*To be continued*)



Engine power curves

Thermostatic Control Considerations

Shortening of Warming-Up Period Reduces Crankcase Dilution—Installations Vary in Detail

By J. Edward Schipper

IN connection with the subject of crankcase oil dilution the question arises, to what extent this trouble may be obviated by the use of thermostatic water-temperature control. There is no doubt that the installation of a thermostat materially reduces the period required to warm up the engine, and, therefore, its use should have a beneficial effect in maintaining the lubricating quality of the oil in the crankcase.

Practical considerations enter into the question whether or not thermostatic control should be fitted. Probably the most important of these is the possibility of restrictions in the water passages, especially in systems not primarily designed for the thermostat. Undoubtedly, in extremely warm weather the effects of such restrictions would be noticeable, unless some sort of by-pass arrangement could be included so that the circulation would not be impeded.

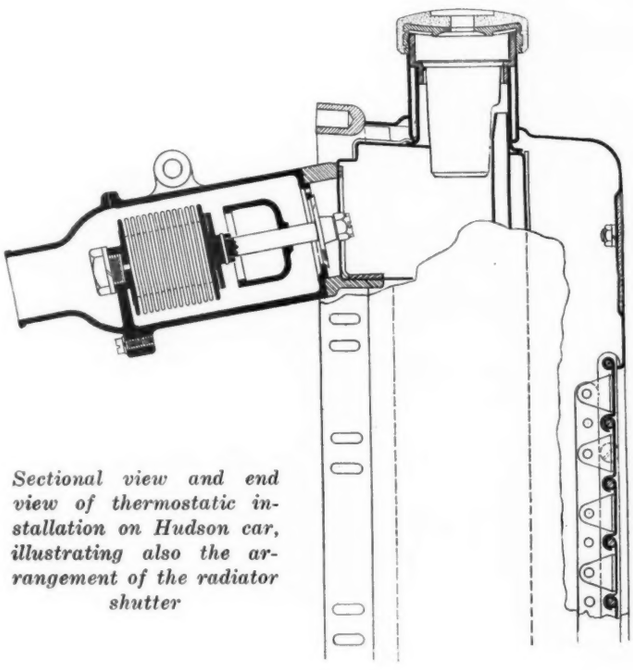
The internal-combustion engine is essentially a heat engine, being used for converting heat energy into mechanical work. In proportion as the heat of the fuel is converted into useful work its efficiency is increased; conversely, the more the heat that passes into the jacket cooling water the lower the efficiency of the engine. In order to establish fairly constant working conditions a thermostat is so placed as to control the temperature of the water leaving the cylinders.

During the winter the advantage of such control is pronounced. When a car is left standing the temperature of the cooling water drops. Upon restarting the engine, if the whole volume of cooling water must be raised to the most efficient working temperature, considerable time must elapse, which results not only in delay and inconvenience to the driver but in the consumption of an extra amount of gasoline because of the necessity of employing the choke, and consequent increased leakage past the rings.

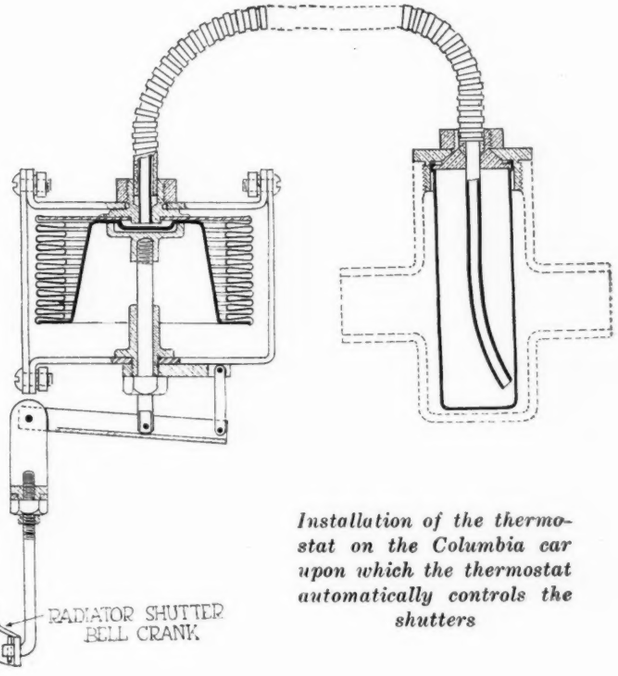
With the thermostat, only a small portion of the cooling water requires heating to the normal temperature. This results in a quicker getaway and a much smoother running engine. Aside from the resulting convenience to the driver, there is a saving in gasoline, because the thermal efficiency is much higher when the engine is working at its best running temperature.

Loss of Alcohol a Factor

Another factor to be considered in this connection is economy of anti-freezing solution. It has generally been found that alcohol solutions make the most satisfactory non-freezing fluid, and these solutions are very extensively used. With the thermostat set at a sufficiently high temperature to justify its use, there is naturally a tendency for the alcohol to be boiled off rapidly. If some provision is not made to take care of this, the maintenance of the solution at its proper strength may become quite a source of expense to the car user. This objection has been overcome by the Cadillac company by

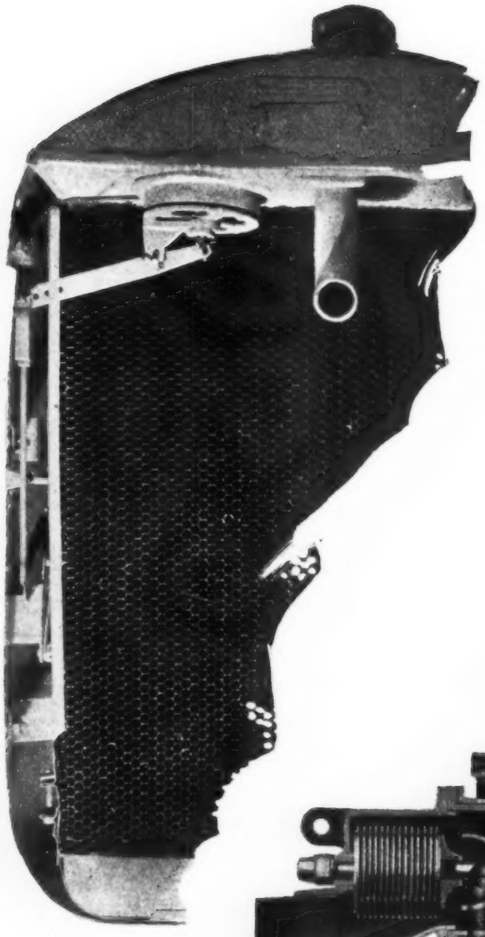


Sectional view and end view of thermostatic installation on Hudson car, illustrating also the arrangement of the radiator shutter

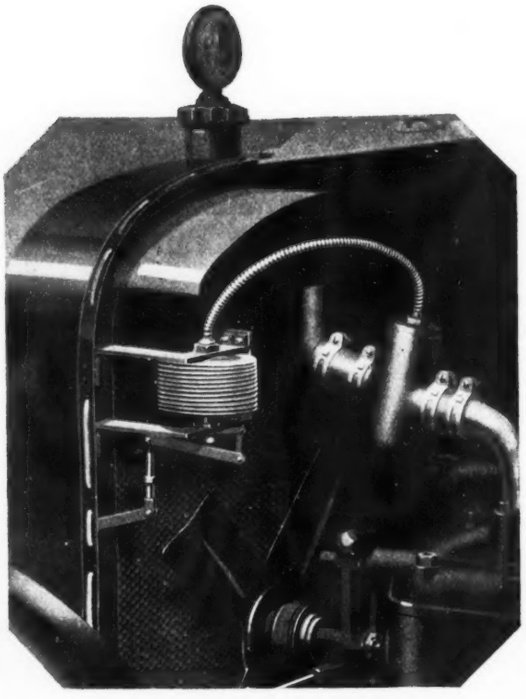


Installation of the thermostat on the Columbia car upon which the thermostat automatically controls the shutters

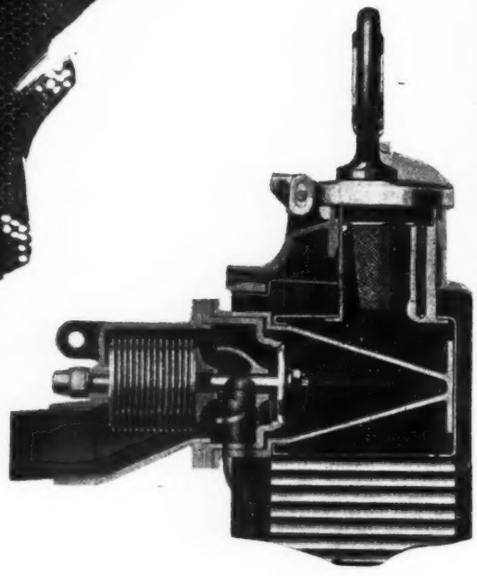
Installations of Thermostatic Circulation Control



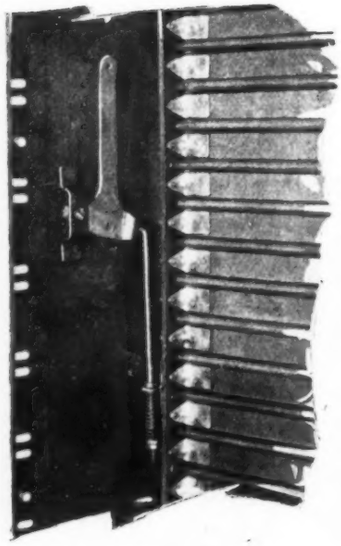
Recommended installation for thermostat in tank of Harrison radiator



Attachment of thermostat behind radiator of Columbia car



Thermostat on Packard radiator



Lever control of radiator shutters for hand linkage on Hudson

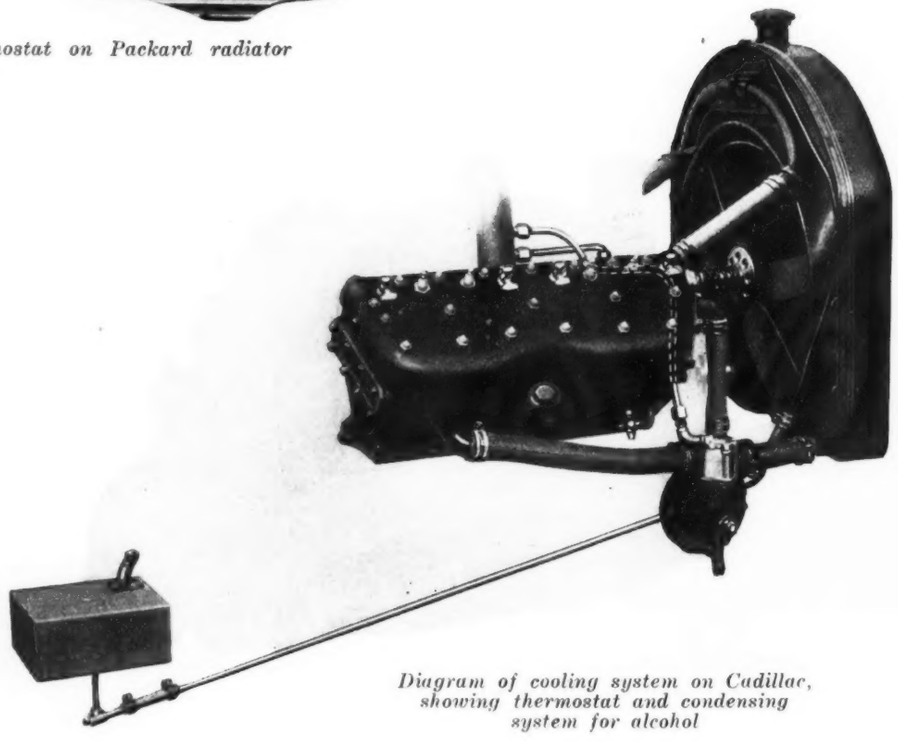


Diagram of cooling system on Cadillac, showing thermostat and condensing system for alcohol

the employment of a condensing apparatus which traps the vapor arising from the alcohol in a small tank beneath the car, from which it can be drained off at intervals and used over again.

If water-temperature control is to be developed further we will probably eventually come to the use of variable cooling surface, that is, variable radiator area. It has often been contended in these columns that it is a reflection on the engineering ability of the industry to see expensive passenger cars on which hundreds of dollars have been spent to secure pleasing appearance carrying a piece of old cardboard or newspaper over the front of the radiator in cold weather.

The use of radiator shutters has been one of the means used to control water temperature. Two well-known cars using the shutters are the Hudson and Columbia. On the Hudson the shutters have nothing to do with the thermostat. On the Columbia the opening of the radiator shutters is controlled by the thermostat. On the Hudson car, the radiator shutter, construction of which is shown in sectional view on page 638, when the thermostatic valve is closed the water is by-passed through the tubing to the intake side of the water pump. When the water has reached the running temperature the taper-seated valve is wide open and the flap valve opening into the by-pass is closed, so that all the water is forced through the radiator. This part of the system is automatic. The remaining part of the system is manually controlled by the driver, who can vary the effective radiator area by means of a lever under the cowl.

The advantage of the independently controlled shutters is that it eliminates the danger of the engine freezing while running. Even after the engine is thoroughly warmed up the water will freeze in the radiator when running into a severe head wind if the full area is exposed. By means of the shutters, with a motometer on the radiator cap, the driver can hold the temperature of the water at the desired point, while the thermostat takes care of the preliminary heating during the warming-up stage.

One objection to thermostat installations having only one valve controlling the flow of the water at the entrance to the upper tank of the radiator is that when the proper temperature has been reached, and the valve opens, the water can either flow into the upper tank of the radiator or into the by-pass tube. It will naturally divide between the two paths in the reverse proportion of their resistances. Such control is not desirable in that the full value is not secured from the radiating surface.

A 30 per cent saving in fuel through the use of the thermostatically-controlled shutters has been claimed by the makers of the Columbia car. A saving of lubricating oil, due to the reduction in crankcase dilution, is also claimed.

Make-Up of Thermostatic Control

Thermostatic circulation-control devices generally consist of two main parts. The first of these is a bulb and flexible tube containing the sensitive liquid, the latter being composed chiefly of ether. This bulb is held in an iron housing placed in the water-return line. The second part is an expansion drum of flexible copper, which is forced open in the manner of an accordion by the action of vapor given off by the contained liquid under the effect of heat. As the motor temperature varies, this drum opens and closes, and operates the shutter through a system of levers.

The thermostat becomes active as the temperature approaches 140 deg. Fahr., and the shutter, which, when closed, permits little water to pass through the radiator, begins to open. This opening action is continued until an engine temperature of 180 deg. is reached, at which temperature the shutter is entirely open. At 180 deg. the motor is working at its maximum efficiency. The highest possible temperature is essential to satisfactory performance with present-day gasoline of low volatility. With thermostatic control the maintenance of the highest possible temperature is rendered possible without danger of overheating the engine, as any variation of temperature affects the thermostat, and the valve is automatically shifted to meet the new condition. A motometer is generally used to show the driver that the temperature of the engine is being properly regulated, and is an essential part of thermostatic equipment.

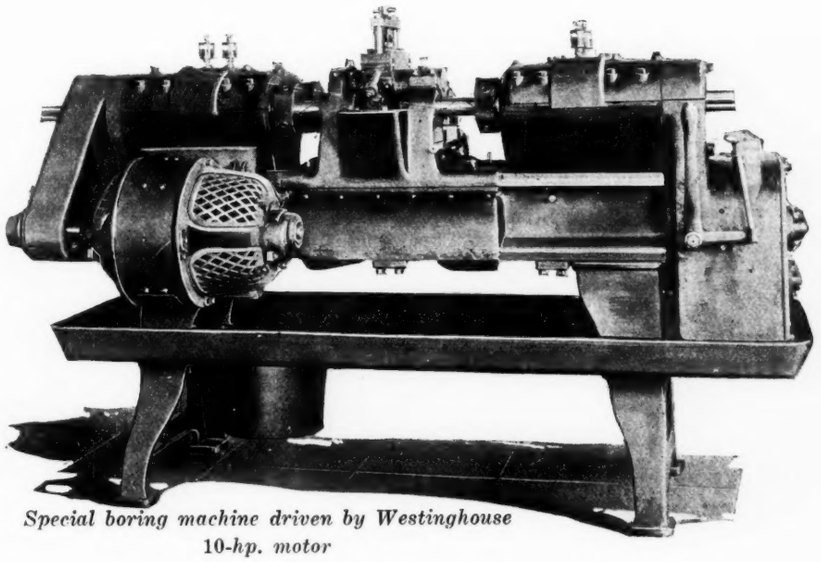
Special Boring, Reaming and Facing Machine

A SPECIAL boring, reaming and facing machine built by the Reed-Prentice Co., Worcester, Mass., to bore, ream and face a steel forging used as an engine support in an automobile is illustrated herewith.

The work is held in quick acting clamps mounted on the revolving triangular turret of the carriage. All of the operations are automatic, with the exception of placing the work in the machine and indexing the turret. Each time the work holder is revolved 120 deg., the finished piece at the top is removed and another rough forging is placed in position with little loss of time.

There are four spindles, two on each of the opposing heads.

Two pieces of work are operated on simultaneously. The cycle of operations is as follows: The carriage moves toward the right; during its travel one piece is drilled and a second piece faced on one side. The carriage then automatically moves toward the left, during which travel one piece is reamed and the second piece faced on its other side, after which the carriage returns automatically to its neutral or starting position, at which point the feed is tripped.



Special boring machine driven by Westinghouse 10-hp. motor

Lauraine High Tension Magneto

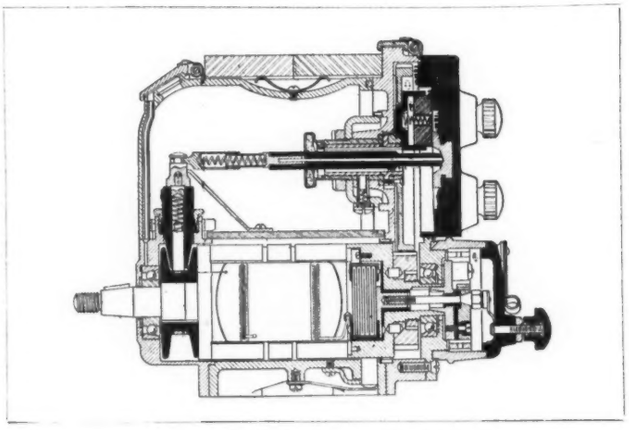
Made in All Standard Types for Terrestrial, Marine and Aerial Use

A NEW high tension magneto has been placed on the market by the Menominee Electric Products, Inc., New York. The machine is of conventional design throughout and is entirely water-proof. It is made in all standard sizes, and in addition to models for motor car, marine, truck and tractor work, a special light model made in aluminum for aircraft work has been brought out. By the use of aluminum and other light material a saving in weight of 4 lb. has been effected.

From the sectional view herewith most of the important constructional details may be seen. The armature is of the Siemens shuttle type and carries both the primary and secondary windings. One end of the primary winding is grounded on the armature core, while the other is carried out to the circuit breaker on the end of the armature shaft. The breaker arm bearing is built up of cross sectional fibre working on a pin which is integral with the main breaker block, thus preventing undue compression and expansion due to moisture or high temperature. The breaker cam is cut from steel tubing which is shaped, hardened and ground to size, and it is claimed that as a result of this construction absolute synchronism is assured. The breaker housing on these magnetos comes with two arms, so the machine may be installed on either side of the engine.

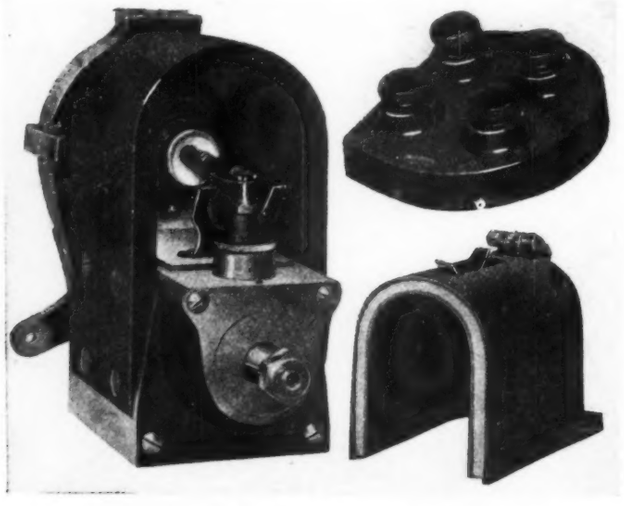
The high tension current is collected from the armature through a collecting ring and brush at the driving end. From this brush the current is transmitted to the distributer. The usual safety spark gap is provided to afford an outlet for the spark in case a high tension cable should come loose from the spark plug or the high tension circuit be interrupted in some other way. The spark at the safety gap may be observed through a small window in the water proofing cover. All parts of insulating material subjected to high tension are made of hard rubber. The distributer gear is adjustable for wear by means of an eccentric bushing, and it is claimed that this will insure quiet operation throughout the life of the machine.

In the Lauraine magneto the water proofing effect is carried out in a somewhat different manner from that found on most other magnetos. The water-proofing cover is inside of the horseshoe magnets, hence the magnets and also the end plate can be removed without disturbing the water-proofing effect. Although the water-proofing cover is inside the magnets, it also can be easily removed, in case it is desired to gain access to parts within it.



Section through magneto

All castings, bases and end plates are made of bronze, which obviates trouble due to warping and consequent disalignment of the parts. The shaft height, shaft end and other features conform to S. A. E. standards. As will be seen from the sectional view, the armature is supported in annular ball bearings, while the distributer is carried in a plain bearing of very liberal size, which is provided with wick oiling.



Lauraine magneto complete, its distributer block and water-proof housing

—

Military Aircraft Problems

IN a paper published in a recent issue of the Journal of the Franklin Institute, W. F. Durand discussed some of the problems encountered in the development of fighting aircraft. Referring to the plan of firing safely through a revolving propeller by mechanism by which the gun is prevented from firing unless the propeller blades are clear, he said that this device was not always effective owing to occasional delayed ignitions. Hence blades were sometimes hit, but in general no great damage resulted. In exceptional cases, however, the injury to the propeller was serious, and might lead to disaster. Another method of firing dead ahead on "tractive" machines was to mount the gun on the upper plane so that it fired over the propeller, but the gun was not then under such ready control.

A third plan was to make the propeller shaft hollow and fire through it. This was only practicable when the propeller was gear driven, but this was now becoming desirable for other reasons since modern engines were being run at rates of revolution incompatible with the high efficiency of a direct driven propeller capable of absorbing the power developed. To get a good propeller efficiency it was, in short, desirable to keep down the speed, while to get a high development of power per pound weight of the engine it was necessary to put up the speed of rotation. With the V type of engine the shaft of a geared propeller might be, he said, conveniently arranged between the two rows of cylinders. In this way any desired gear ratio could be adopted, and by making the shaft hollow a path for the bullets was provided free from any possible obstructions.

Dimensions of Steel Tube Struts*

With Formulas and Graphs for Use in Selecting the Proper Size of Tube for Different Lengths of Strut and Loads

By Carlo Maurilio Lerici

THE accompanying graphs have been prepared in order to facilitate the calculation of the dimensions of such circular and streamline steel tubes as are employed in airplane construction. The diagrams give directly the compression permissible for a maximum load of 10 kg. per sq. mm. (13,750 lbs.-sq. in.); that is to say, with a factor of safety of six for steel commonly employed having an ultimate strength of 60 kg. per sq. mm. (82,500 lbs.-sq. in.). The streamline section tube is that of minimum resistance (Fig. 1), tested by Eiffel and adopted as standard by nearly all the constructors of the world. The fineness ratio of this section is about 3. The ratio of the two moments of inertia I_{xx} and I_{yy} is about 5. It will be easily seen that there is an almost constant relation between strength in compression of circular and streamline steel tubes.

For the standard type (Fig. 1) I have found that the streamline tube whose section has the external dimensions $d \times 3d$ has the same compressive strength as a circular section tube of the same length and thickness (gage), having an external diameter $= 1.5\ d$. This factor has formed the basis for the graph Fig. 2. The following data are given: $W =$ normal compressive load, $L =$ length of tube. The graph shows that for each value of W there are generally several solutions according to the different values of the thickness adopted. In this connection it should be noticed that, in order to attain maximum lightness, one should adopt the minimum possible thickness s. The ratio of s to d should not be less than 1/30.

It should also be pointed out that the condition of minimum weight for streamline tubes exposed to a current of air, as the struts of an airplane, is only convenient in machines having a low flight speed. Generally it is possible to so dimension these tubes as to render minimum the power absorbed by their weight and by their head resistance. In the best of modern high-speed machines the total power P absorbed by one meter of streamline tube exposed to the air is given by the formula:

$$P = \frac{dv^3}{10^6} + \frac{34vds}{10^4}$$

d in cm.
s in cm.
v in metres per second.

$$P = \frac{7.25dv^3}{10^5} + \frac{7.85vds}{10^3}$$

d in inches.
s in inches.
v in. ft.-in.

An examination of this formula gives the following results: (1) For machines having a speed of not more than 120 km.

*From *Flight*.

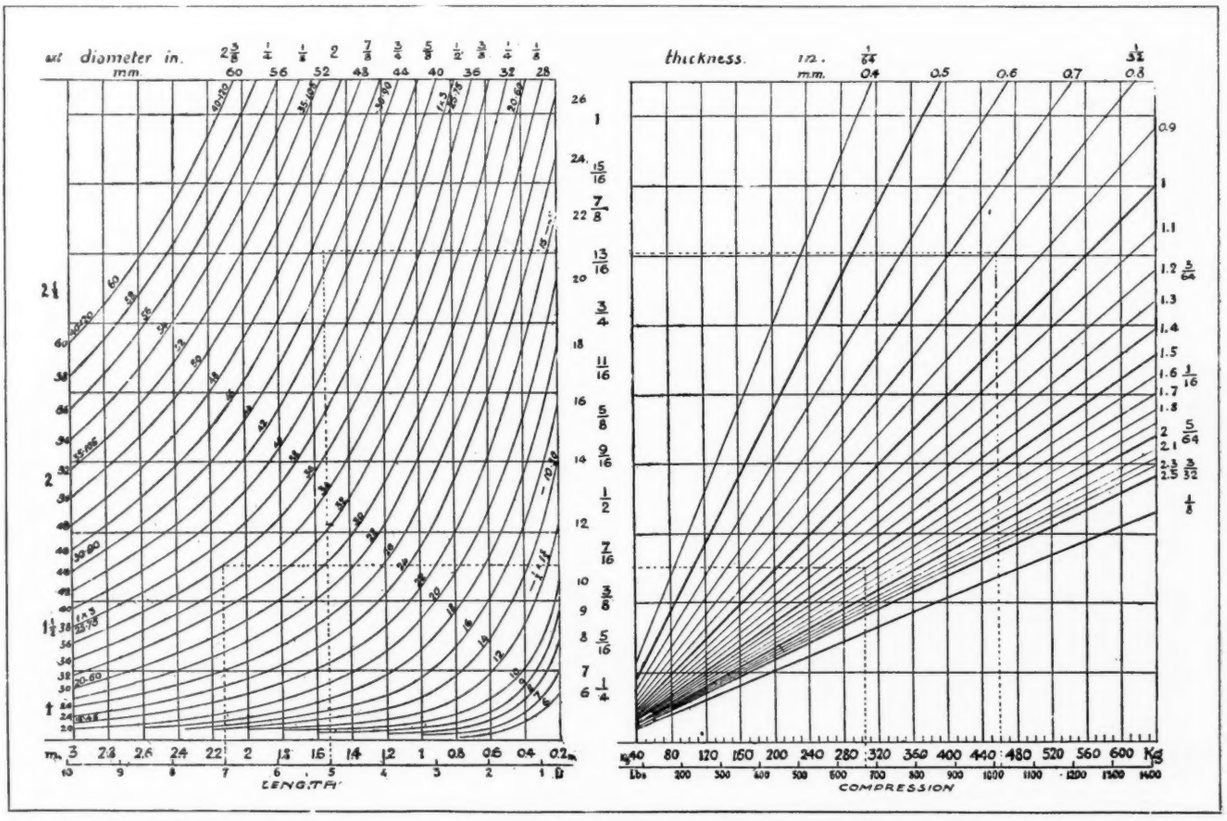


Fig. 2—Diagram showing strength of circular steel tube struts of various dimensions, the material being assumed to be steel of 74,000 lb. per square inch tensile strength. For the section shown in Fig. 1 the values found for circular struts must be divided by 1.5.

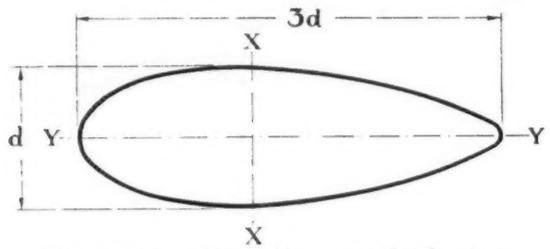


Fig. 1—Streamline section of steel tube strut

per hour (75 m.p.h.) the minimum value of P is obtained by giving the struts a thickness of between 0.8 and 1.6 mm. (1/32 in. and 1/16 in. respectively). (2) For machines of which the normal speed varies between 120 and 160 km. per hour (75 and 100 m.p.h.) the optimum thickness varies between 1.2 and 2 mm. (3/64 in. and 5/64 in.). (3) For speeds between 160 and 200 km. per hour (100 to 125 m.p.h.) the optimum thickness varies from 1.6 to 2.4 mm. (1/16 in. to 3/32 in.). (4) For speeds above 200 km. per hour (125 m.p.h.) the struts should be given the maximum possible thickness, weight having no longer any appreciable influence.

It sometimes happens that one has to depart from these dimensions giving maximum efficiency in order to avoid during flight every vibration that might diminish the compressive strength of struts. For instance, this happens when the frequency of the struts' proper vibration under normal load coincides with or is a multiple of the number of revolutions of the motor. Such a phenomenon of resonance can be countered by modifying one of the dimensions s or d.

The following examples show the method of using the graph:

(1) *Center Section Strut.*—Streamline section. Steel of 60 kg. per sq. mm. (82,500 lbs. per sq. in.). Factor of safety = 6. Length, 7 ft. Compression in strut, 670 lbs. Thickness $s = 1/16$ *in.* From the diagram it will be seen that the circular tube has an external diameter of 36 mm. (1 7/16 in.). Streamline tube having same length, $d = 36:1.5 = 24$ mm. (61/64 in.). As the fineness ratio of the strut is three, the dimensions should be about 1 ft. 3 in.

(2) *Chassis Strut.*—Streamline section. Steel, 60 kg. per sq. mm. (37 tons per sq. in.). Factor of safety, 6. Length 5 ft. Compression under normal load, 1020 lbs. Thickness 1/32 in. The circular tube indicated in the diagram as being of the requisite strength for this load has an external diameter of 45 mm. (1 13/16 in.). Streamline tube having same strength $d = 45:1.5 = 30$ mm. (1 13/64 in.). As the ratio of s to d is less than 1/30, it will be advisable to adopt a thickness of 3/64 in. In that case $d = 41:1.5 = 27.5$ mm. (1 3/32 in.).

Helping the Jobber Through the Dealer

By Allen Sinsheimer

THE Marvel Accessories Mfg. Co., Cleveland, Ohio, sells its products to the jobber. The jobber distributes them to the retailers. The dealers retail them to the public. At first glance the business of the Marvel company comprises chiefly the problems of manufacture and the organization of jobber distributors. But the company operates more intensively. It builds on the principle that its products are not sold until they are in the hands of the consumer, and it extends its sales activities beyond the jobber to the dealer.

The entire country is divided into territorial districts, each under the control of a responsible salesman, who sells to the jobbers in his district, and in addition, following the company's plan, also supervises the dealers in his territory. Each new dealer is watched. Aid and advice are given. And every jobber is urged to follow the same principle and to maintain sufficient stock to meet the dealer requirements.

Advertisements are placed broadcast by the company, reaching to every field, and creating a constant interest in the products. All inquiries resulting from the advertising, and sent to the maker, are in turn handed to the jobber or dealer, as the case may be.

Recently the company started its largest campaign based on:

Advertising in many publications.
Window signs for the dealer.
Lantern slides for the dealer.
Folders for the dealer.
Outdoor "gas" signs for the dealer.
Counter display signs for the dealer.
Circulars for the dealer's use.
Newspaper electros for dealer's use.
Demonstration patches.
And wall hangers, catalogs, etc.

Postal cards were forwarded with an announcement of the campaign to dealers, who were requested to check the advertising needs desired and to return the cards to the company's offices.

Each folder, window hanger, etc., was given particular attention, and was designed to carry a certain message. The campaign started at the height of the tire vulcanizing season. September is the month when motorists attempt to make used tires do for a period and carry them to the repair shops, and the company issued several pamphlets calling attention to its vulcanizing kits, which allow the motorists to vulcanize their own tires, besides a large window sign and a metal display card that can be attached to the gasoline pump, where every driver can see it.

A catalog of newspaper electros was sent broadcast, and resulted in hundreds of orders for electros from dealers who will co-operate in the campaign.

In the same way, pamphlets, folders, leaflets and window signs, designed to sell valve grinders, socket wrenches, chain fasteners and other products, were mailed to all dealers. The plan has been found extremely effectual, working prosperously for the company, jobbers and dealers, and welding all three into a close, harmonious manufacturing and distributing organization, where each division aids the other to a very important degree.

Discussing Metric System

THE British Institution of Electrical Engineers recently discussed the probable effect on the British electrical trade of the introduction of the metric system, especially in those markets in which the English system is now in vogue, with a view to determining whether the compulsory introduction of metric measures should be pressed or resisted.

IT is very important that in designing a charging equipment for electric motor vehicles provision should be made for boosting charges at high rates. The need of boosting may not at the outset be apparent. With roads in average condition, the possible mileage capacity of each vehicle may be ample for the daily service requirements. But inevitably there comes a time when the condition of the roads, combined possibly with high wind, is such that the energy taken per vehicle mile rises by from 50 to 100 per cent above normal. It is under such conditions that provision for boosting saves the situation and permits of the usual delivery service.

Testing Electric Ignition Apparatus*

Notes on the Measurement of Current in Electric Ignition Spark Circuits

By J. D. Morgan

IN connection with the testing of electric ignition apparatus, namely, magnetos and induction coils, it is required to measure the current in the high tension spark circuit. Owing to the complex character of the current, the problem of measurement is a difficult one. At present the problem appears to be incapable of complete solution, and the task of producing a practical instrument resolves itself into devising means which will give useful indications when subjected to the actions of different currents having the same general characteristics.

The currents in the spark circuit of a magneto or induction coil are intermittent and oscillatory. In most cases the oscillations are superimposed on a unidirectional discharge. Also the oscillations are divisible into two successive parts, in the first of which the frequency is enormously higher than in the second. Plotting current against time, the general characteristics of a single discharge are related, as shown in Fig. 1. In some special cases the discharge is as shown in Fig. 2. Possibly the first part (a) consists of a series of oscillations, but the frequency is so great that the image of the spark in a rotating mirror is seen as a single bright line. The image of the second spark (b) is seen as a row of parallel lines which are much less bright than the first. It is to the current corresponding to the first bright line in the spark image that the difficulty of current measurement is due. This current is associated with the self-capacity of the spark generator. When the interrupter in the primary circuit is opened there is a rapid change of flux in the system. For a short interval at the commencement of this change a small quantity of current is stored due to the self-capacity of the generator. When the voltage reaches such a value that it breaks down the spark gap, the stored current discharges and produces the first part of the spark. It follows that this part of the spark has a practically constant value.

Tractors Affecting Spark Energy

In all ignition apparatus the current in the spark circuit depends on the speed of operation of the spark generator and the size of the spark gap. In magnetos provided with means for varying the position at which the contact breaker is opened in the revolution of the armature, current variations also accompany adjustment of the contact breaker. The character of the variations found in a normal magneto is as follows: Keeping the gap constant and fixing the contact breaker, the current increases with the speed. Keeping the speed constant without varying the contact breaker, the current increases with diminution of the spark gap. Keeping the gap and speed constant the current diminishes at low speeds when the contact breaker is moved from the "advanced" to the "retarded" position, and at high speed increases continuously or passes through a maximum

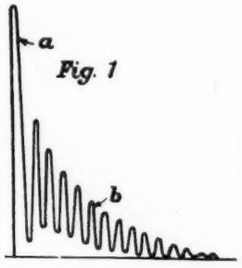


Fig. 1

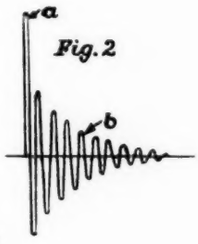


Fig. 2

value with the same adjustment of the contact breaker.

Obviously, any current-measuring instrument to be useful, must be capable of indicating the changes above mentioned, and to anyone unfamiliar with the problem it may appear remarkable that there should be any pitfall to avoid in constructing a suitable instrument. Some form of thermal ammeter or galvanometer is likely to give the best results, and several forms have been tried with ignition apparatus. In two, the heated element carrying the current to be measured consisted of extremely fine wire of comparatively low resistance. These instruments were of exquisite construction, but both showed a surprising behavior. With each a diminution of current was indicated with a diminution of spark gap instead of an expected increase. One indicated a constant current instead of a current which increased to a maximum and then decreased when at a certain speed of the magneto the contact breaker cam was moved from the advanced to the retarded position. Both gave at all

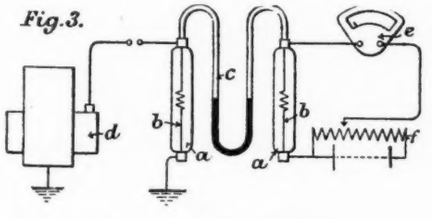


Fig. 3.

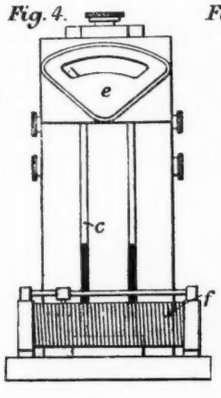


Fig. 4.

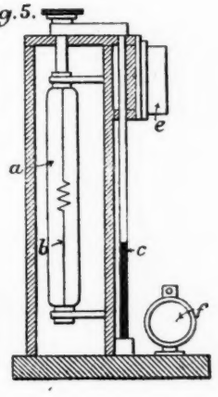


Fig. 5.

*From *Engineering*, London.

speeds current values which were known to be much too high. One of these instruments was made to behave in a proper manner by E. A. Watson, by the inclusion in the instrument circuit of an inductance and a capacity which shunted the extra high frequency component of the current past the instrument and allowed only the component of lower frequency to pass through it.

Developing Measuring Instrument

Proceeding on different lines, the writer concurrently developed for his own work another type of instrument, the scheme of which is shown diagrammatically at Fig. 3 and the general appearance at Figs. 4 and 5. A pair of similar glass chambers *a* containing a metal or carbon filament *b* are connected to a capillary fluid indicator tube *c*. One of the filaments is connected to the spark circuit of the magneto *d*, as shown, while the other is connected to a battery circuit through a milliammeter *e* and variable resistance *f*. The heating of one of the chambers by the magneto current is balanced by the heating of the other by the battery current. With the particular filaments used, it is found near enough for practical purposes to take the milliammeter readings as the equivalent of the magneto current when the balance is obtained. Comparison with the instrument corrected by Mr. Watson shows that the indications of the two instruments agree very closely.

An essential condition of success in the instrument shown in Fig. 3 is that the filaments shall be of relatively high resistance. In the first model 16 cp. carbon filament lamps were used, these having a resistance of 1500 ohms each. Later cylindrical lamps recognizable in the drawings, and provided with comparatively thick metal filaments of 500 ohms resistance, were used, and found quite satisfactory. These instruments are sufficiently sensitive, and show the current variations which are expected from the theory of the ignition apparatus under test.

Ammeters for Complex Currents

In designing thermal ammeters for complex currents having widely different oscillatory components, it is necessary to pay careful attention to the heated element. If the element is made of low resistance, the instrument readings will be determined mainly, if not solely, by the high-frequency component of the current, whilst if wire of high resistance is used the readings will be determined mainly, if not solely, by the low-frequency component. Taking a typical experiment, one of the instruments first mentioned in this article was connected to a magneto, and its indication was found to be not only excessively high, but also constant for all positions of the contact breaker cam when the speed was kept constant. The only component of the current which could remain constant under this condition was the extra-high frequency component and the current value attained in it is undoubtedly much higher than in the other. Using the writer's instrument, the current value was much lower, and, repeating the test the expected variations were indicated.

It follows from the foregoing that different types of thermal instruments and varieties of the same type can give very different accounts of the same piece of ignition apparatus. Further, it follows, that in setting up a standard instrument it is necessary to settle beforehand which of the two current components shall be taken as the main or sole basis of comparison. A variety of considerations which are irrelevant to this article, and which are based on the properties of ignition apparatus, as well as on certain phenomena, lead the writer to the conclusion that it is the current of lower frequency which is the more useful for comparative measurements.

—

Brake Lining with Jute Backing

OUR attention has been called to a new method of making brake linings and clutch facings which consists, briefly stated, in weaving a fabric with an asbestos facing and a jute or cotton backing, the asbestos preferably having the usual wire reinforcement. This fabric is then given substantially the usual brake lining or clutch facing treatment. The advantage claimed for this new material is that the jute, cotton or other material used for a backing is somewhat more resilient than the asbestos and thus enables the brake or clutch in which it is used to take hold more gradually. In the case of a three or four-ply fabric, it is proposed to make one or more of the middle plies of jute or cotton and use asbestos for the outside plies. The manufacturers anticipate a great future for this material.

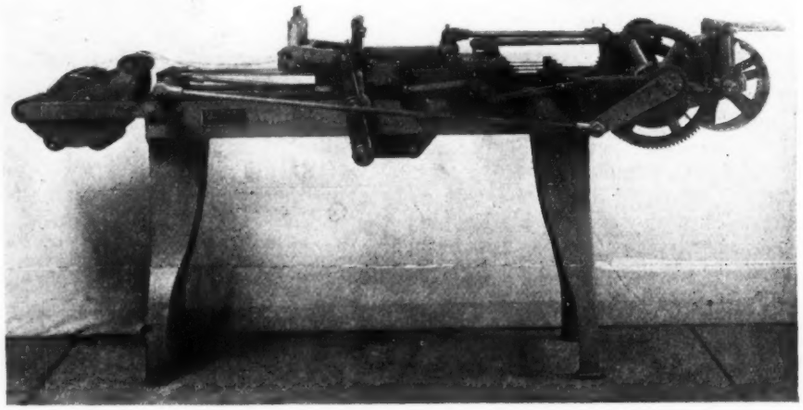
—

Automatic Machine for Making Radiator Cells

THE accompanying photograph illustrates a special machine built for the F.I.A.T. Co of Turin, Italy, by the Stolp Co., Inc., Geneva, N. Y. The Fiat Co. has large orders for cars and trucks from the Italian Government and also makes the power plants for the Caproni biplanes. Its output is such that 2000 radiator cores are required per month, and this requires forty operators to produce the cells, using ordinary dies and tools, by which the cells are made in four operations.

With the machine just developed by the Stolp Co. three operators, one on each machine, will do the work, resulting in an enormous saving in wages. In addition to the saving in wages there is a saving in material. Formerly the Fiat company made its radiator cells from brass ribbons 55 mm. wide, but the machines make the same tubes from stock only 50 mm. wide, producing a perfect lock seam.

It is generally admitted that the cellular types of radiator are the most efficient, on the basis of the amount of metal used. That it is not more extensively used has generally been attributed to the large amount of labor required in its construction. It is possible that the introduction of this new machine will have a tendency to popularize the cellular radiator again.



Machine for making radiator cells

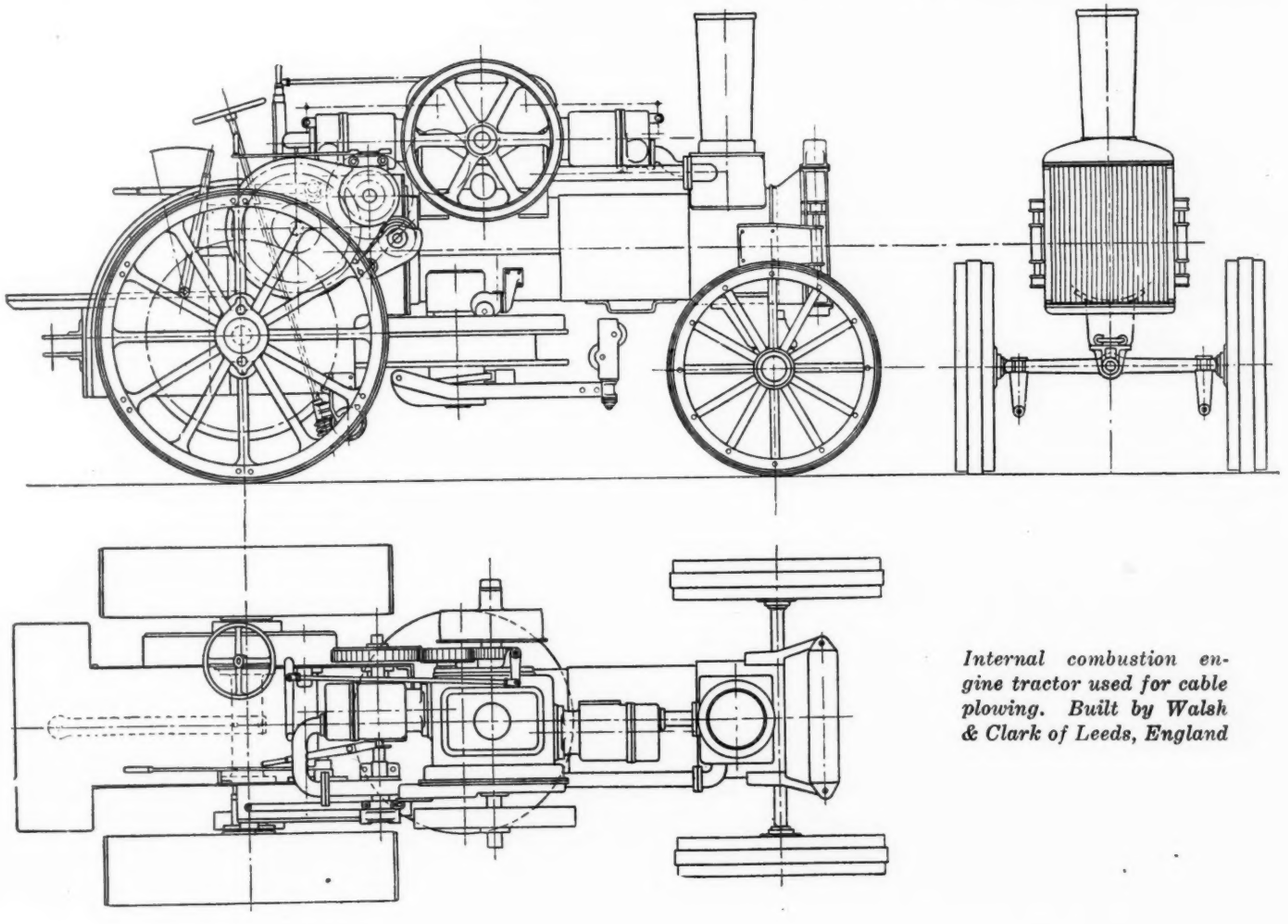
British Gasoline Cable Tractor

Advantages of Cable Plowing—Description of a British Gas Tractor Designed for Hauling Plows Through the Intermediary of a Cable

IN Great Britain the cable plow has had quite a vogue for a good many years, but almost exclusively in connection with steam power. Tillage by this system has several advantages over that done by horses, or even by the direct traction method now so much in use. It enables a much greater depth to be cut, and thus gives protection against both excess of rainfall and drought, while a more thorough mixing and disintegration of the manure with the soil is brought about. Another possible advantage is that plowing by this method can be carried on when the land would not be in condition to carry a tractor, provided the engines can be taken to the headlands. But a set of steam plowing tackle involves the expenditure of a considerable amount of capital. With the object of providing an equipment less costly than the usual steam plant, the firm of Walsh & Clark, Limited, of Guiseley, near Leeds, England, has designed a plowing set which operates on the cable system, but in which the motive power is supplied by internal combustion engines which are started on gasoline but run mainly on kerosene. Severel views of the machine are shown herewith, the drawings being reproduced from *The Engineer*. Each engine weighs close upon 6 tons, and is rated at from 30 to 35 brake horsepower at an engine speed of 600 r.p.m. when traveling or plowing, and 22 brake horsepower on the driving belt.

As will be seen, the engine is of the horizontal pattern. It is secured to the barrel frame, and has two cylinders, 7 in. diameter by 8-in. stroke, with cranks set at 180 deg. On one end of the crank shaft of the engine is a simple clutch pulley, while on the other end is a flywheel. The clutch pulley has a long sleeve machine-cut steel pinion with twenty teeth, which meshes with a spur wheel with fifty teeth on a second motion shaft. This shaft serves to transmit motion either to the winding drum or to the road wheels. In the former case a sliding bevel pinion is brought into engagement with a bevel wheel keyed on a vertical shaft, on the lower end of which is a spur pinion which engages with teeth on the inside of the rope drum. The vertical shaft is carried in cast-iron bushes in brackets secured to the cross plate of the engine frame. The sliding bevel wheel is moved in and out of gear by means of a lever from the driver's seat. The movement of this lever also serves to operate a hand brake on the vertical shaft to prevent the drum running back and unwinding the rope.

On the right-hand end of the second motion shaft above mentioned are two floating steel pinions, either of which can be brought into engagement with a double spur wheel on the third motion shaft, on the other end of which a pinion is keyed. This pinion drives a large spur wheel which runs loose on the main axle, but can be secured to the road wheels by two pins. The road speeds thus provided are 2¼ and 4½



Internal combustion engine tractor used for cable plowing. Built by Walsh & Clark of Leeds, England

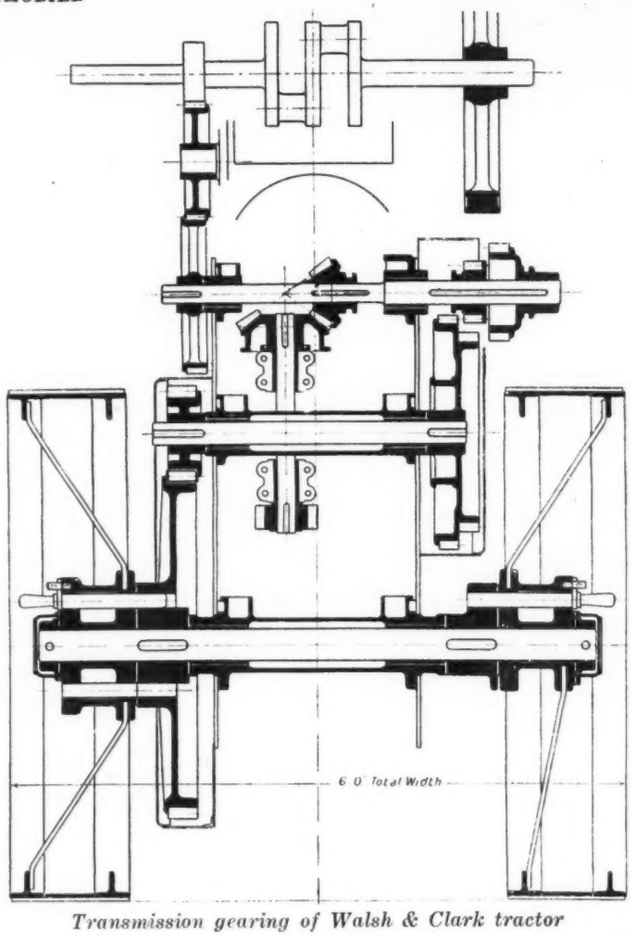
m.p.h. The driving wheels are 5 ft. diameter by 14 in. wide and are fitted with cross strakes, while the front wheels are 3 ft. 7½ in. by 8 in. wide. No differential gearing is provided. Reversing is effected by means of a wide pinion carried in a swinging link and engaging with the large double spur wheel on the third motion shaft, and the slow speed pinion on the second motion shaft. Locking gear is provided to prevent any two gears being in mesh simultaneously.

The barrel portion of the engine is used as a fuel oil tank, and besides giving the maximum stiffness to the whole machine, thus provides storage space for 50 gal. of fuel, which is enough for over four days' plowing operations. The barrel is 1 ft. 9 in. diameter and is made of ¼-in. steel boiler plates. The winding drum is carried by a stiff stud plate, ½-in. thick, double riveted to the shell and with a stiffening plate inside. The horn plates are of ⅜-in. boiler plating riveted to a cross plate at the rear end of the barrel. The third motion and main axle bearings are extended right across to each horn plate, and give further rigidity to the frame.

The valves of the engine are placed in the water-jacketed cylinder heads, and are operated by rocking levers and rods from two separate cam shafts in the engine crankcase. These cam shafts are driven by 2 to 1 spur gearing from the crankshaft, and a centrifugal governor mechanism is provided in the gearing to operate the throttle valve in each cylinder head. When starting from cold, gasoline is used, and is admitted to a small tank on each cylinder, from which it is drawn into the cylinders. The kerosene is also delivered by a pump into these fuel tanks, but on its way to the cylinder passes through a vaporizer formed by a nest of tubes in the exhaust passage. The engine is fitted with high-tension magneto ignition and impulse mechanism for giving a hot spark at starting.

The engine is designed to exert a continuous pull on the rope of 3500 lb. It is intended to haul a four-furrow plow on medium and light land, and a three-furrow plow on heavy land. A pair of engines can, we understand, plow from 7 to 10 acres per day of 10 hr., according to the nature of the land, and with rope speeds of from 250 ft. to 350 ft. per min. They will also cultivate from 14 to 20 acres per day. The winding drum carries 450 yd. of steel rope, which is coiled automatically by means of special coiling mechanism. The clutch pulley is 1 ft. 9 in. diameter by 6 in. face, and the flywheel 2 ft. 9 in. diameter by 4 in. face, and the engines are fitted with brakes to act on the drum on the large double gear on the third motion shaft. The steering is by hand wheel, worm and chain.

The special features of the radiator are the method of mounting it on the front end of the cylindrical frame and the means provided for inducing a current of air around and through the flanged tubes. The method of supporting the radiator is shown in the illustration, and requires no further description. The draft is caused by passing the exhaust gases round a large conical nozzle in the base of the chimney.



Transmission gearing of Walsh & Clark tractor

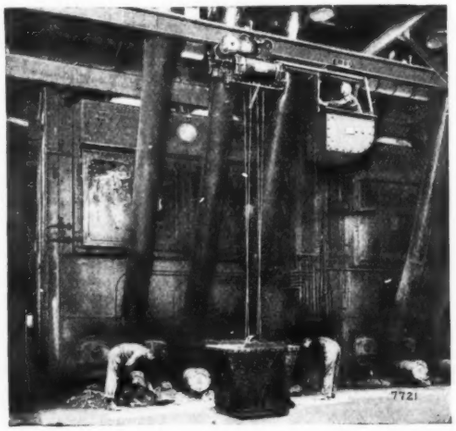
Summed up in a few words, the Walsh & Clark engine is a miniature replica of the large steam plowing engine as regards the cable mechanism, with the power supplied by a kerosene engine. The machine can also be employed as a tractor, whether for road or field work. On level roads it can haul a weight of 8 tons gross at 5 miles per hour. On the land it can haul plows taking a four-furrow plow over light land cultivators, harrows, etc.

Improved Ash Handling Apparatus

A MONORAIL electric hoist, with a bottom dumping bucket, lends itself readily to installation in existing boiler houses for ash handling purposes. This is especially true where the ashes are pulled out on the boiler room floor, which is often the case. The accompanying view illustrates an installation of the Link-Belt monorail hoist in the boiler house of a paper company.

This machine runs on the lower flange of an I-beam track. It is operated by a man traveling in a trailer cage, who controls the raising or lowering of the bucket, as well as the travel of the hoist. The laborers who clean the fires fill the bucket with ashes; the operator then hoists his bucket and runs it out directly over the car, where he dumps it, by the motion of a lever in the cage. The current required is said to be very small.

In this instance, the superintendent designed his own track support, the Link-Belt Co. of Nicetown, Philadelphia, Pa., furnishing the track and conductor. While he did the work quite cheaply, he also made a good job of it. About 30 tons of ashes are handled. They are pulled out every six hours. Two men do the work of shoveling into the buckets, and then one of them gets into the cage and runs it out into the car. At other times, to hurry the work, an additional man operates the hoist, remaining in the cage. The bucket holds 1¼ cu. yd. and is handled by a 2-ton hoist.



Removing boiler room ashes by overhead monorail hoist

Collier Assembling 1500-Lb. Wagon

Furnishes Choice of Three Bodies and Electric Lighting and Starting for $885 f.o.b. Factory

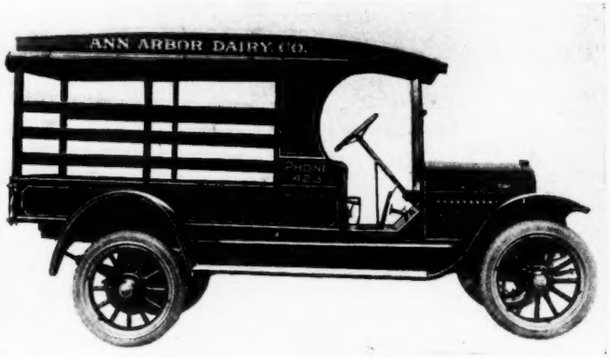
THE Collier Motor Truck Co., Bellevue, Ohio, is marketing a ¾-ton truck, selling for $885, with a choice of three body types. The truck is mounted on a 118-in. wheelbase chassis and has a 7-ft. loading space. The price includes the body, lighting and starting system. The truck is adapted to a wide range of usage where ability to carry heavy loads is not required but rather ability to make frequent and quick trips. In order to make relatively high speed practicable the truck is equipped with pneumatic tires.

The chassis is an assembled unit having a Lycoming engine, Mechanics Machine Co. clutch and gearset, Salisbury axle, Goodrich tires and Salisbury wheels. The car is shaft driven. The Lycoming engine is a four-cylinder type with two crankshaft bearings. Its bore and stroke are 3¼ by 5 in., the cylinders being cast in one block, with the valves on the right side. Cooling is by thermo-syphon circulation in connection with a cellular radiator having a pressed steel radiator case. Ignition is by a single system (Connecticut) with current from a Willard 6-volt, 80 amp.-hr. battery. A two-unit starting and lighting system (Auto-Lite) is provided as stock equipment. The carbureter is a Zenith, and fuel is fed to it by gravity.

The transmission system comprises a Raybestos faced, dry disk clutch. The selective three-speed gearset is mounted in a unit with the engine. The gears and rear axle provide a reduction of 6, 10½, and 18 to 1 forward, and 24 to 1 reverse. The drive is by means of a direct bevel gear through a three-quarter floating axle to the rear wheels. The propulsion is taken through a torque arm, which also absorbs the braking and starting torque. The springs are semi-elliptic all around. The wheels carry 32 x 4 in. tires.

The construction of the chassis is along conservative lines, a straight after section being used beneath the pay load and a slight bottle-neck effect forward of the center. This narrows at the front end of the frame to permit of shorter turning radius and also makes for a shorter supporting arm for the power-plant and radiator. The torque arm is bolted to the differential housing and to the central cross member. There are two universals in the drive, as will be noted from the plan view of the chassis herewith. The chassis frame is of pressed steel, 4 in. deep. The steering gear is a worm and gear type with an 18-in. hand wheel and with springs in the connecting link to the front axle for absorbing shocks.

The bodies offered are of the open express, side panel delivery and semi-closed type with side curtains.

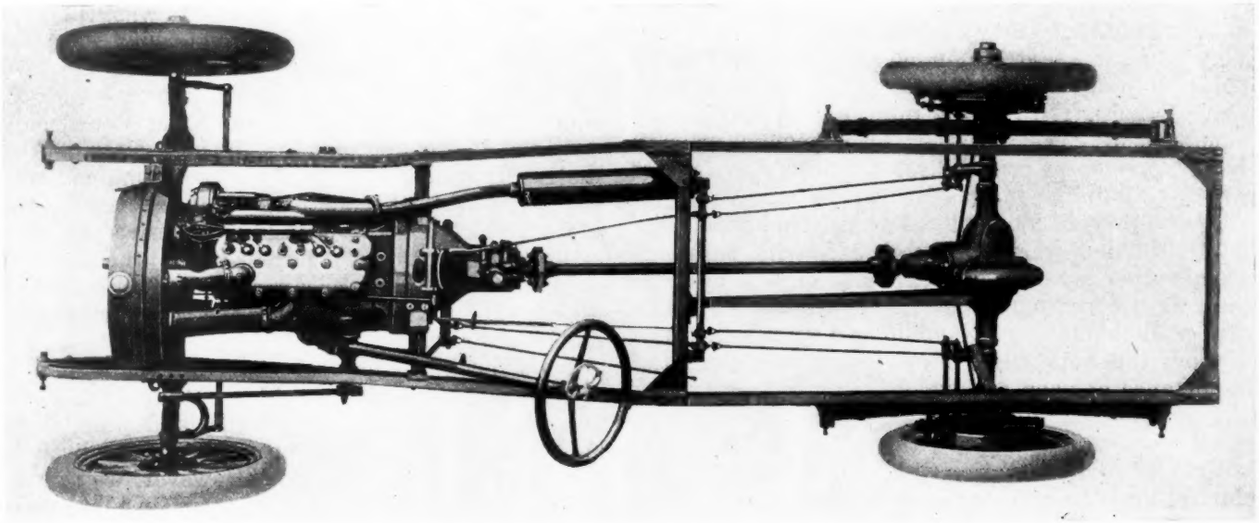


One body type offered with the Collier truck

—

Flexible Coal Gas Containers

FROM information gathered by the Gas Trade Committee, it appears that so far about 4500 commercial vehicles have been adapted to the use of coal gas as fuel in England. Orders have been placed for 2500 additional flexible gas containers, all for commercial vehicles, and these are to be completed during the next few months. So far less than 4 per cent of the orders received by the manufacturers of these flexible containers have been for private vehicles, and no further such orders will be accepted. Practically all of the work on these containers is done by female labor. It is estimated that as a result of the use of coal gas for operating motor vehicles a saving of 3,000,000 gallons of gasoline a year is effected.



Plan view of Collier ¾-ton truck chassis

AUTOMOTIVE INDUSTRIES
The Automobile

PUBLISHED WEEKLY
Copyright 1918 by the Class Journal Co.

Vol. XXXVIII Thursday, March 28, 1918 No. 13

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, General Manager
231-241 West 39th Street, New York City

BUSINESS DEPARTMENT
Harry Tipper, Manager

EDITORIAL
David Beecroft, Directing Editor
A. Ludlow Clayden P. M. Heldt
Sydney Oxberry

DETROIT OFFICE
J. Edward Schipper Allen Sinsheimer

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—Guardian Bldg., Phone Main 1142.

Cable Address - Autoland, New York
Long Distance Telephone - 8760 Bryant, New York

SUBSCRIPTION RATES

United States and Mexico	One Year,	$3.00
Canada	One Year,	5.00
Foreign Countries	One Year,	6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order or Register your letter.

Owned by United Publishers Corporation, Address 243 West 39th St., New York; H. M. Swetland, President; Charles G. Phillips, Vice-President; W. H. Taylor, Treasurer; A. C. Pearson, Secretary.

Entered as second-class matter Jan. 2, 1903, at the post-office at New York, New York, under the Act of March 3, 1879.

Member of the Audit Bureau of Circulations.

Automotive Industries-The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Shall Our Road System Break Down?

HOW shortsighted we can be at times is well illustrated by the discrimination against road materials in the priority regulations. We have now come to realize that the public highways bear to the business life of the country the same important relation as the arteries to the internal economy of the human body. Yet, in the Government's priority orders, one of the classes first discriminated against was road-building material.

At the present moment our richest industrial districts are in a veritable cul-de-sac, with railroads crammed to capacity and the only outlets in some cases in a condition which defies description. The case of Michigan can be held up as a specific instance of how the authorities have failed to realize the importance of good highways.

This commonwealth, with a war order budget that is growing rapidly toward the billion dollar mark, with a railroad situation that only a miracle can clarify, finds its war traffic dependent upon a trail which is more like a bottomless pit than a road and which *in some parts is only 9 ft. wide!*

Between thirty and fifty military trucks, loaded with war material, plow their way daily over this Michigan road. In their wake are hundreds of commercial and passenger cars bound for Eastern points. Millions of dollars' worth of commerce taking this route is held up on a 9-ft. road and no permanent relief is expected by local road authorities before Aug. 1. At this time a year ago, August, 1917, was the date set for the completion of the permanent road.

This is only an example of what holds true in many other localities. Why should not the Government put a thousand men to work on a road of this kind? In a foreign military country it would have been done long since, as it would have been realized how serious a matter it is to have traffic of this importance in constant jeopardy. It is too long to wait until Aug. 1, particularly when past experience shows that little credence can be placed in a prediction of this nature.

One of the reasons given for the non-completion of many of the roads last fall was the embargo on road materials. This should never come up again. The Government would not think of holding up materials to repair and maintain the railroads of the country. The tonnage carried over the highways this year will far exceed the tonnage of any previous years and will probably overshadow that moved on the railroads. By all means let us watch the more essential highway arteries more closely than ever. Let us maintain them and keep them clear of mud in summer and snow in winter. Their importance cannot be over-estimated.

A New Phase in Standardization

AN effort is now being made to get the authority of the Federal Government back of certain standards which it is proposed to formulate and which cover machine parts of very general use. Standardization in this country originated in the automobile industry, and the rapid growth and prosperity of this industry during the past seven or eight years are by many believed to have been due in no small degree to this practice. It was, therefore, but natural that standardization should spread to other industries, and it was a first step in this direction when the motor boat, tractor, motorcycle, stationary engine and aircraft industries joined hands with the automobile industry in the Society of Automotive Engineers. But even the combined automotive industries constitute only a part of our mechanical industries, and if it is desired to standardize screw threads, for instance, the standard should be sponsored by an organization whose influence is coextensive with the industries using machine screws.

No doubt in the natural course of events all of the mechanical industries would eventually realize the advantages of certain standards, and possibly the standards of one of the most aggressive branches would be generally adopted. However, we are now at war, and quick action is essential in the removal of any barriers to rapid and efficient production. Screw threads have been standardized in the past,

and for a wide range of sizes there are now three different pitches, covering a very wide range of conditions of use. However, to make screws truly interchangeable it is not sufficient to specify the pitch and form of thread. It must be realized that whatever the dimensions specified, these cannot be obtained in commercial work with absolute accuracy. We had a good illustration of this when the S. A. E. spark plug thread was first adopted. The object of this plug standard was to make it possible to use any make of spark plug in any engine. It was soon found, however, that the plug threads often came slightly over-size and could not be screwed into the cylinders. There was something lacking in the plug specifications, as originally drawn, which has since been supplied, and that is tolerances.

The same thing applies to screw threads in general. It is commercially impossible to make a screw thread of any definite pitch diameter, etc. Certain limits must be set within which these dimensions may vary, and this is the tolerance. Without tolerances it is impossible to have screws made in one plant and nuts or machine parts with tapped holes of the same nominal size in another and have any screw fit any nut or hole.

It is a rather novel proposition that the appointment of a commission to adopt screw standards should be made the basis of action by Congress. It is not the power of Congress to enforce the commercial adoption of any standard which may be formulated, but rather the prestige which would be given the standard by the sanction of Congress that is motivating those who are championing the bill. If it were not for the relation of the matter to the war it would seem that the formulation and promulgation of such standards would come within the province of the Bureau of Standards. What makes direct action by Congress more desirable in this case is that the screw thread standard is needed particularly in the work of the War Department and of the Navy. Now, the Bureau of Standards is a part of the Department of Commerce and there seems to be an aversion on the part of the branches of our Government to make recommendations or take action that might be construed as interference with other departments. Action by Congress would remove any question of authority.

Airplane Wing Coverings

BEFORE the war practically all airplane wings, ailerons, rudders, etc., were covered with linen. What makes this material especially adapted to the purpose is that, besides having great strength in proportion to weight, due to the long fibers of flax, it can be rendered taut and very smooth by treatment with acetate or nitrate dope. However, it was not long after the great value of the airplane for scouting and bombing purposes was realized and large-scale aerial programs were laid down by the different nations that the supplies of flax, from which linen is made, ran short. By far the greatest flax-growing country previous to the war was Russia, whose acreage sown to that crop was more than 80 per cent of the world's total. Next came Austria, Italy and Roumania in the order named, followed by Germany and France. Realizing the great demand for linen that would arise the various governments at an early date imposed embargoes on flax and linen, but in spite of these embargoes and of every possible encouragement to flax growers the supply has not kept up with the demand and substitutes have had to be looked for.

Experiments have been made with both cotton and silk, and it is understood that the former has given the best results in every respect. This is most fortunate, as the supplies of cotton—even of the special grades of long staple used for the purpose—can be greatly multiplied and produced at much less cost than silk. One of the chief objections to silk, and which it shares with many other fabrics, is that it does not hold the dope, so the covering cannot be made as taut and smooth as a dope-treated linen covering, and hence does not permit of reducing the skin friction to the same low figure. We are informed that the problem of a satisfactory wing covering of cotton fabric has been fully solved and that large contracts for such material have been given by allied governments.

On the other hand, there has been some talk of the Germans using metallic wing coverings. While the proposition may have been given some thought, there has been no evidence in descriptions of captured enemy planes of its having passed into practice, and as all the leading flax-producing countries of the world are now either under enemy control or commercially accessible to the enemy it is hardly likely that he will waste much time finding linen substitutes.

Force Feed Oiling

IT has long been known that force feed oiling is especially desirable in engines operating at high speed and running most of the time close to full load. Everybody will admit that a bearing to which oil is supplied under pressure in a constant stream will withstand a higher pressure per square inch than a bearing dependent on splash oiling or gravity feed. Once in a while a record has been set up by an engine using the splash system of lubrication and this has tended to create the impression that if correctly designed the splash system is as efficacious as the force feed system.

It is all a matter of bearing surface. With each system there is a critical bearing load which must not be exceeded if risk of failure is to be avoided. If the bearings are made sufficiently large so that the critical pressure for splash lubrication can not be exceeded then splash lubrication will give satisfactory service.

However, in an aircraft engine where high weight efficiency is a prime essential, it is impossible to provide this liberal bearing surface, and the force feed system of lubrication is the only one justified. In fact, the pressure under which the oil is fed should be rather higher than has been customary in the past.

□ Latest News of the

St. Louis To Use Return Loads

100-Mile Radius To Be Employed—Ohio Urges Its Use

WASHINGTON, March 27.—The return loads system of motor truck transportation is taking hold in many sections of the country. St. Louis, Mo., is organizing a truck organization to handle the return loads business for St. Louis and surrounding country within a radius of 100 miles under the direction of the St. Louis Chamber of Commerce. The State Council of Defense of Illinois has appointed an active committee to work with the chambers of commerce and commercial organizations throughout the state to establish return loads bureaus. Numerous inquiries are coming into the offices of the Highway Transport Committee asking for information about the establishment of return loads bureaus. Detroit, Chicago, Cincinnati, Cleveland, Youngstown, Pittsburgh, Buffalo and a number of other cities are already establishing some motor truck transportation, although very few as yet have created return loads bureaus.

The above information was brought back to Washington by Frank E. Williamson of the Highway Transport Committee, who addressed the National Industrial Traffic League in Chicago on March 20, where he explained the objects of the committee and its work establishing return loads bureaus in cooperation with chambers of commerce and other commercial organization in the territory north of the Ohio River and east of the Mississippi to the Atlantic seaboard. The National Industrial Traffic League is composed of the principal shippers and manufacturers of the United States and Mr. Williamson's address has resulted in numerous favorable inquiries from league members.

The Highway Transport Committee is publishing a pamphlet which will be ready for distribution early next week and which will explain in detail how return loads bureaus can be established and maintained. The pamphlets will be distributed to all chambers of commerce, public service commissions, state highway commissions and municipalities. Pamphlets can also be obtained by application to the Highway Transport Committee, Munsey Building, Washington, D. C.

The Highway Transport Committee has received word of organized effort by the Ohio branch Council of National Defense to supplement steam and electric railroad transportation by motor truck transport. A meeting was held at Columbus early this month and representatives of traffic bureaus of the chambers of commerce in the principal Ohio cities conferred with the transportation committee of the Defense Council. A resolution was drawn up stating the need for additional transportation facilities and it was recommended that return loads bureaus be established in all cities. A sub-committee of the Defense Council was named to work out the development of this plan. The development of systematic motor truck transportation through country districts for the collection of milk from farms to be delivered in cities will assist materially to solve the difficulties which confront the chief and efficient production and distribution of milk in Oho.

—

Continue Iron and Steel Prices

WASHINGTON, March 26.—The President to-day approved the recommendation of the Price Fixing Committee of the War Industries Board that the maximum prices heretofore fixed by the President upon the recommendation of the Board, upon ore, coke, steel and steel products, subject to revision on April 1, 1918, be continued in effect until July 1, 1918; from April 1 to July 1, however, the maximum price of basic pig iron be reduced from $33 to $32 per gross ton, and that the maximum price of scrap steel be reduced from $30 to $29 per gross ton.

No new contracts calling for delivery of any of these commodities or articles on or after July 1, 1918, are to specify a price unless coupled with a clause making the price subject to revision by any authorized United States Government agency, so that all deliveries after that date shall not exceed the maximum price then in force, although ordered or contracted for in the meantime.

—

Stock Market Reflects Curtailment

NEW YORK, March 27—There has been a direct reflection in the stock market of the action of the government in reducing automobile production by 30 per cent, a condition which is but natural. During the past two weeks 26 of the listed automobile stocks have shown declines of from ½ to 4 points. Among these that have dropped most have been Chevrolet, which went down 4 points, Fisher Body Corp., 4 points, Maxwell preferred 4 points, and Studebaker 3 points. To offset this there have been some gains, such for example as Hupp preferred and International common, 5 points, International preferred, 11 points, U. S. Rubber 8 points.

No Chrome Steel Shortage

California Has Large Supplies —80,000 Tons in Storage

WASHINGTON, March 27—There will be no shortage of chrome steel for some time to come if at any time. This announcement can be made following investigations by industries interested which reveal:

Eighty thousand tons of chrome has been stored away which has been owned by a huge metallurgical concern, hoping by its storage to increase prices.

Thousands of tons of chrome ore have been found in California mines.

After six months of deliberation and waste of time Washington officials have ordered electrodes supplied to the California mines, which means that the chrome ore mined in this country will be refined and supplied for use.

Some idea of the value of the 80,000 tons of chrome that has been hidden away may be had from the fact that in past years we have only imported 28,000 tons of chrome per year. In other words, a three-year supply of chrome was stored away.

Following this long delay, the War Industries Board has notified the Shipping Board that we can use the chrome on hand and that mined in California and that ships to and from New Caledonia, from which point we have heretofore secured chrome ore, may be diverted to other uses.

Rumors have been current in Washington for several weeks of lack of cooperation between the California chrome miners and the eastern metallurgical companies controlling the necessary electrodes. There were also reports that the War Industries Board refused to recognize the great supply of chrome in California and refused to order priorities allowing shipments of electrodes to the Western Coast. Recently several individuals interested both in the automobile business and the parts industry and also in the California chrome made thorough investigations, which were placed before the War Industries Board and practically forced them to move.

—

Hodgkins Resigns From Studebaker

DETROIT, March 27—R. T. Hodgkins, general sales manager of the Studebaker Corp. of America, has sent his resignation to the company, effective April 1. He has not announced his future plans yet.

Automotive Industries

Rumors Exaggerate Airplane Delay

Temporary Hold-Up Should Be Overcome in Next 90 Days—50 Engines Completed Last Week, 100 This Week—Makers in Production Within Next 60 Days — Many Derogatory Reports Misleading—Program Includes 22,000 Planes

WASHINGTON, D. C., March 26—Washington atmosphere is heavily charged with airplane delay rumors, and while the airplane program is behind schedule and while there have been delays the real situation is very frequently misinterpreted and unconsciously misrepresented. The entire airplane industry is so little understood in this country that it is not surprising that foolish rumors get wide circulation. Nobody connected with the airplane activity denies the delay in schedule, but the next 90 days should bridge what is now known as the delay period, and by that time production will be well under way in several factories, whereas to-day production is really under way in but one factory, and that factory is 90 days behind its schedule.

There are many reasons for delay, and while many of the public will be impatient with these they should give reasonable heed to them. Changes had to be made in the Liberty engine from the first design developed last July, and while the engine contained nothing new or untried the development of an airplane engine of its size was without precedent in this country or even in Europe, and many unexpected conditions arose from the greater production of power from the engine than was originally expected. At the start the engine was expected to show a little over 300 hp., but now it has shown over 400 hp., and naturally some parts that were designed on a 300-hp. basis are proving too light for the greater power output obtained.

Changes Were Necessary

In the original design the crankshaft oiling system was not a complete pressure system, and after testing some engines it was discovered that a complete pressure system was necessary. Such a change has been made. The greater power output has called for some heavier parts, such as strengthening the crankshaft and strengthening the connecting rods and wrist pins. A small change in some of these parts calls for changes in other parts closely related to them. There were some features of design that had to be changed, and it would have been a miracle if such changes had not had to be made. These changes have been exaggerated in some circles. There have been clerical delays in conjunction with these changes, and there has been a certain amount of lack of co-operation which has not been intentional but rather due to a rapid increase in organization and handling of certain work by men not familiar with airplane work.

Certain delays in manufacture have been caused by difficulties with materials entering into certain parts of the engine. The specifications of the steels have made some of these parts slow to produce and has resulted in a heavy rejection of parts by inspectors. This has been true with connecting rods and perhaps some other parts.

Picture Too Sanguine

Perhaps public criticism to-day is due very largely to the too sanguine picture of our airplane possibilities painted last spring after it was decided that the airplane was the eye of the army and that by great fleets of planes would it be possible to destroy the effectiveness of the Hun artillery and so destroy the effectiveness of the enemy. In those days there were stories circulated of fleets of 100,000 airplanes started by newspaper men rather than by those in charge of the airplane program. Other papers talked of fleets of 50,000 and others dropped in the scale to 25,000. Nobody at that time had the slightest conception of what it meant to produce a 400-hp. engine such as the Liberty, and even to-day it is a sad commentary that such a small percentage of our talking and gossiping public has so little information on what it means for a factory to get into production on such a job. This situation cannot justly be laid at the feet of any one official, as all agreed that secrecy must surround the development of the airplane, and during the months when this veil of secrecy was enveloping the nation there were millions of citizens unconsciously dreaming of those tens of thousands of airplanes that were to point the road to Berlin.

In those days no one thought of the I. W. W. activities in the spruce forests of the West and had any conception of how production of planes could be held back by the work of such forces. Nobody anticipated the railroad situation and the delays in materials caused by it. Nobody foresaw the pro-German activities that have destroyed machine equipment for factories. Nobody dreamed of the dangerous unknown traitor within our ranks who is responsible for a score of the evils that have crept into our factories. These all have contributed to the present regrettable quota of delay in which production is 90 days behind what it was scheduled for in the picture-painting days of last July and August.

Recent and present investigations of aircraft conditions are not, contrary to general opinion, directed against either Howard E. Coffin or the Aircraft Production Board as a whole. The above facts were brought out to-day in a conference with aircraft officials of this city.

Production Board Is Advisory

The Aircraft Production Board, of which Mr. Coffin is chairman, is really only an advisory organization. The laws incorporating it specifically state that the board must not duplicate any office or organization now existing in military or naval services. Therefore, also contrary to the public impression, actual production, inspection, accounting and contracting as regards airplanes for our military establishment reside in the hands of the Signal Corps, and if any one or any department is being investigated it is the Signal Corps with its commanding officer, General Squier. This above explanation clarifies the mysterious situation of the past few weeks wherein it appeared as if Mr. Coffin, who went to Detroit with the Snowden Marshall committee to investigate Detroit airplane conditions, was helping to investigate himself.

Conditions at this time can be described as follows: Fifty Liberty airplane engines were completed last week according to authoritative statements made here to-day, and nearly 100 Liberty airplane engines should be completed by the end of this week.

(*Continued on page* 659)

Army Well Equipped with Motor Vehicles

Ordnance Department Has Tremendous Supply of Trucks, Tractors and Trailers—Production Continues Steadily

WASHINGTON, March 25—The Ordnance Department, greatly expanded by the war urgencies, has developed a tremendous equipment of tractors, trailers and motor trucks to augment the military establishment. Forty-eight new 4-ton trailers have just been completed in design and will each carry complete equipments designed for making various repairs in the field and behind the lines, and these will soon be in process of production.

Special schools have been established at Rock Island Arsenal for equipment repairs, motor equipment repairs at Peoria, Ill., and supply work at several arsenals. Many of the commissioned and the enlisted personnel are having instruction at these schools and in addition a number of field artillery officers have been sent to acquire knowledge of motor equipment care to provide for emergencies that may arise in active duty.

There are eight heavy artillery mobile repairshops to an army, each consisting of two sections capable of independent operation, the general function being to make moderate repairs to heavy artillery and its motor equipment. Each section is composed of a repair and a supply organization.

Repair Subsection

The subsection, devoted to repair, is made up of three 3-ton trucks of the repair type called tool room trucks, air compressor trucks and forge trucks, and five 4-ton trailers of the machine shop type called generator, lathe, welding set, drill press and shaper and milling machine trailers. There are also provided a 4-ton crane trailer and a motorcycle with side car.

The supply subsection contains six 4-ton trailers of the supply parts type, which are completely housed and provided with bins of various sizes, similar to those in a stock room; six 3-ton trucks of the repair type for carrying large spare assemblies; two motorcycles with side cars, one solo motorcycle and one 1-ton delivery truck.

A complete section is further provided with one 4-ton trailer with machine shop body and two 3-ton trucks with repair body for transporting baggage; one 3-ton truck with repair body slightly altered and equipped with desks, files, etc., to be used as an office; one 3-ton truck of the ammunition type for carrying fuel in drums; one touring car and one rolling kitchen of the trail mobile type.

Each shop is commanded by a major assisted by one second lieutenant as adjutant. The commissioned personnel assigned to one section is one captain commanding; one first lieutenant in direct charge of the repair subsection, being assisted by a second lieutenant; one first lieutenant in charge of the supply subsection, records and files.

The enlisted personnel totaling 103 are of various grades from ordnance sergeant to private, acting in capacities of expert machinists, electricians, inspectors, mechanics, ignition and carbureter experts, blacksmiths, welders, assemblers, testers, chauffeurs, stockkeepers, helpers, etc.

For traveling purposes each of the twelve trucks of the repair type hauls a 4-ton trailer and the tank truck, the rolling kitchen, leaving the light delivery truck free for general purposes, the motorcycles being employed for dispatch and agent service.

Special Parking System

In the general scheme of operation the vehicles are parked so as to occupy three sides of a rectangle, leaving an end open for entrance of repair jobs to the park, the supply and spare parts trucks and trailers usually occupying one side, the power and machine tool trucks and trailers the other, leaving one end for the office and delivery trucks together with motorcycles and passenger cars. The personnel are quartered under canvas or such shelter as the commanding officer may direct constructed.

The generator trailer contains two 15 kw. D.C. generators, each being directly connected to a separate gasoline engine in order that one set may be overhauled without shutting down. A three wire system is employed giving a total output of 30 kw. for power and lighting.

The air compressor is directly connected with a 40 hp. gasoline engine identical with that installed in the trucks, and compresses 70 cu. ft. of free air per minute, delivered at 125 lb. pressure. A 100-ft. armored hose of 1 in. diameter is provided to deliver air to the appropriate hammers, chippers, etc.

The lathe trailer contains an 18-in. lathe with an overhead trolley chain hoist to handle heavy jobs.

Forge and Tool Room Trucks

The forge truck contains a large portable forge, anvil, rivet furnace, and a complete set of blacksmith's tools.

The tool room truck contains a 9-in. lathe, a bench drill, a combination cutter and drill grinder, and a complete outfit of small tools.

The welding set trailer is completely fitted with apparatus for oxy-acetylene welding, together with a low pressure acetylene generator of large capacity.

The drill press trailer contains a 21-in. drill press and a shaper, together with complete tool equipment.

The milling machine trailer contains a 9-in. lathe, a precision lathe, a milling machine, and a sensitive drill press, an optical repair chest for the repair and parts replacement of optical instruments.

The standard ordnance motor vehicles are as follows:

The *ammunition truck* consists of a steel body mounted on a four-wheel drive type of truck chassis. The body is designed to accommodate original packing boxes of any type of ammunition. This body will also conveniently carry five 55-gal. steel tanks for gasoline, oil and water supply. In general it is intended to use this body wherever an ordnance truck is required for heavy cargo purposes.

The *equipment repair truck* consists of a repair body mounted on a four-wheel drive type of truck chassis. The body is fitted with bins and chests of drawers for spare parts and raw material for repairing personal equipment, machine guns, pistols, rifles, leather equipment, etc. Machines for sewing leather and canvas, work benches, etc., are supplied, together with the necessary hand tools for making the above repairs.

The *artillery repair truck* consists of a small machine shop repair body mounted on a four-wheel drive type of truck chassis and constitutes a small repair shop. The equipment consists of a lathe, drill press, bench grinder, portable electric drill, oxy-acetylene welding outfit, air riveting hammer, milling attachment, blacksmith outfit, and an assortment of the necessary tools to repair artillery material and motor vehicles. Electric power is supplied by a small gasoline-driven generator mounted on the truck. It is intended to use this truck with possible minor variations in equipment wherever the service of such vehicle is necessary. This truck is ordinarily accompanied by an artillery supply truck carrying tools, spare parts, raw material, bar stock, etc., for use in connection with such repairs.

Artillery Supply Truck

The *artillery supply truck* in motorized batteries takes the place and carries the equipment of the battery and store wagons of what was formerly horse-drawn field artillery. The equipment consists of tools, spare parts, etc., pertaining to the particular type of cannon to which assigned. This vehicle is also used as a companion truck to the artillery repair truck wherever it may be used for carrying spare parts, material, etc.

The *artillery tractor, 2½-ton,* weighing about 5000 lb. and capable of crossing bad ground at a speed of 10 m.p.h., or developing about 12 m.p.h. under favorable road conditions, will be provided for handling the reel and cart attached to the battalion and regimental headquarters of motorized artillery regiments in place of the 6-horse team used in horsed regiments.

The *artillery tractor, 5-ton,* weighing about 9000 lb. and having speeds of 1½ m.p.h., 3 m.p.h. and 6 m.p.h., respectively, is intended for use with 4.7-in. gun and 6-in. howitzer material, each tractor hauling one-half a section or other loads not exceeding 10,000 lb.

Artillery 10-Ton Tractor

The *artillery tractor, 10-ton,* weighing about 17,000 lb. and having a low speed of about 1½ m.p.h., and capable of developing 4½ m.p.h. or a little better on high speed, is intended for use in motorized regiments of 6-in. guns or for loads weighing up to 18,000 lb., such as a large howitzer broken up into smaller units for transportation.

The *artillery tractor, 15-ton,* weighing 26,000 lb. and having speeds of 2⅛ and 3½ m.p.h., and the *artillery tractor,* 120-hp., weighing about 28,000 lb., and having speeds of 2⅛ and 3½ m.p.h., will be supplied in limited numbers. These tractors are of the track-laying type, similar to those used by the French and British Governments, and are used for handling heavy loads which are not subdivided for transportation.

The *reel and fire control truck* consists of a four-wheel drive truck chassis, having the

rear wheels replaced by caterpillar tracks to improve the ability to negotiate bad ground, and a wire reel, mounted on the rear end of the truck. Between the reel and driver's seat are located chests for carrying fire control instruments, on which a number of men may also sit. This vehicle will have a speed of 12 m.p.h. or better.

The *reconnaissance car* consists of a 1-ton rear drive type of chassis, having mounted upon it a steel body suitable for carrying from twelve to fourteen men with necessary storage space for fire control instruments. This car is capable of developing from 30 to 40 m.p.h. under full load.

The *light repair truck*, weighing about 2400 lb., consists of a small box body mounted on a light chassis. It carries chests containing carpenters' and machinists' hand tools, automobile tools and supplies, lubricants and greases, and is used for light emergency repairing and general utility work.

Anti-Aircraft Trailer

The *1½-ton anti-aircraft trailer* is supplied to transport the 75 mm. improvised anti-aircraft gun. Two trailers are used to transport each piece, one carrying the gun and cradle, and the other, the gun platform.

The *3-ton anti-aircraft gun trailer*, weighing about 4200 lb., is designed to have permanently mounted upon it a 75 mm. anti-aircraft gun. This trailer also carries a box containing ammunition.

The *3-in. field gun trailer*, weighing about 4400 lb., is so designed that 3-in. gun material and similar vehicles may be easily loaded upon it and transported at high speed behind motor trucks. After the guns are placed, the trailers will be available for bringing up ammunition, provided road conditions are favorable enough for their use.

Other trailers of various types are furnished for special purposes, which vary from those carrying corps repairshop equipment to those of sufficient capacity to transport tractors and tanks and damaged vehicles at high speed on good roads.

Tanks and other armored land vehicles are designed, procured and maintained by the Ordnance Department.

Varieties Minimized

While the Ordnance Department has probably had to design a greater variety and handle a greater volume of motor equipment than any other department of the Government, there has been a continuous and successful effort to keep the variety of vehicles and parts to the absolute minimum consistent with the necessities of the service and, unless absolutely impracticable to do so, to use parts already in service in France or used by some other branch of the Government.

There is, for example, only one size of tire used on all the heavier trucks and trailers, and this size is also used on similar vehicles by the Quartermaster Corps, Signal Corps and Engineers. One size of tractor uses in its engine practically every part of the B-engine used by the Quartermaster Corps.

Magneto Same on All Vehicles

The same magneto is used on all ordnance vehicles and in emergency is readily replaceable with the magnetos used by other departments.

Four sizes of standard tractors have been developed and adopted to meet the needs of the artillery service, and these tractors, when required by any other branch of the Army, will be supplied by the Ordnance Department to reduce the number of types.

All the types of the ordnance truck bodies are interchangeable on all truck chassis issued to the artillery, to facilitate changes in the field. Numerous other examples could be mentioned of the effort to keep parts to a minimum and effect co-operation between the departments of the Government.

Government Opens Schools

Several Departments Cooperate to Train Selected Men in Management of Workers

WASHINGTON, March 26—Various government departments co-operating in an intensive training course of employment management have established schools. The first will open to-day at the University of Rochester and others will soon open at Harvard University, Massachusetts Institute of Technology, Boston University and the Boston Employment Managers Assn. The first course will continue for 6 weeks, and include both the theory and practice of employment management. Fifteen Rochester factories have arranged to provide the laboratory work and assist the university in presenting the theory of personnel management.

Only men selected by manufacturers of war contract plants and who possess industrial experience, good education, liberal point of view and the ability to command men will be accepted. The Department of Labor is sending two of its field agents in the federal employment service, and it is announced that the Navy Department intends sending assistant superintendents from navy yards. Twenty prospective employment managers have already been accepted and enrolled.

Purpose of Plan

The purpose of the plan is to add a fourth general division to every industrial enterprise personnel, consisting of employment or service management. This department will cover all those activities which have to do with human relations; legislation, safety, education, recreation, "hiring and firing," discipline, wage system, pensions, sick benefits, etc., bringing them all under one department.

Although this type of work is new, it had some development before the war, and during the last three years an association of employment managers was organized in Boston, Detroit, Philadelphia, Chicago and Cleveland. A representative of the Industrial Service Section of the Ordnance Department has remarked that all cases of labor difficulty which have been brought to their attention could have been avoided if the factory in question had already established a modern employment department. The Quartermaster Department cites an instance where two mills, side by side, working on the same type of material and employing the same sort of labor, got totally different results from the workers. One had a well-conducted employment and service department and the other had not. The former got better results all around and avoided strikes, although it paid a slightly lower wage. This, it is claimed, was due to the fact that justifiable complaints were attended to by the employment department as they arose.

The co-operation of manufacturers is desired in that they send carefully selected students to the course. Organizations desiring to send students should apply to Captain Boyd Fisher, 5207 New Interior Building, Washington, D. C., who represents the several departments co-operating.

—

230,000 Men in Shipbuilding

WASHINGTON, March 25—Shipbuilding in American yards is now employing 230,000 men, and as yet there has been no shortage of labor except of highly skilled men, according to a statement by the Department of Labor. Within the next 6 months 150,000 more men will be needed, and these will be obtained from the ranks of the unemployed and the United States Public Service Reserve, which has more than 225,000 men enrolled.

—

Italy's Exports Almost Doubled

TURIN, ITALY, March 20—Exports of automobiles and trucks from Italy during the first 10 months of 1917 amounted to more than $20,000,000, and included 916 trucks and 614 cars. This is an increase of 92 per cent over 1916. During the same period Italy imported 251 vehicles at a cost of $251,000, which is only one-fourth of the amount imported in 1915.

Detailed figures follow:

Exports for 10 Months Ended Oct. 31

Year	Number	Value	Increase over Previous Year
1917.....	8,530	$22,453,361	92 per cent
1916.....	4,936	12,110,870	19 per cent
1915.....	3,879	10,113,395	

Imports for 10 Months Ended Oct. 31

1917.....	251	$251,000	60 per cent*
1916.....	319	638,705	40 per cent*
1915.....	386	1,027,892	

*Decrease.

—

Trucks for Food Shipment

WASHINGTON, D. C., March 22—An appropriation for $100,000 for experiments in utilizing motor trucks for shipments of food to large cities, authorization to the Secretary of War to turn over to the Postmaster General for use in mail transportation all airplanes and automobiles unsuitable for military purposes and a recommendation to charge 24 cents per ounce for airplane mail were contained in the Post Office appropriation bill approved Tuesday by the full Senate committee which has ordered the bill favorably reported.

$875 for Ford Tractor with Plow

War Preparedness Board Fixes Price for Michigan After Conference

LANSING, MICH., March 27—A price of $875 for the tractor sold by Henry Ford & Son to the State of Michigan has been fixed by the war preparedness board, after a consultation with representatives of the Oliver Plow Co., South Bend, Ind., and Henry Ford & Son, Dearborn. This price includes the two-bottom plow.

Prior to the consultation, the price set on the Oliver plow was $97, arranged by Ford without the sanction of the plow company. It was explained to the war board this price was for a foreign contract, and was a flat price without any repairs, service or demonstration. With the price fixed at $125, the company agrees to send experts into the field and see that every plow works properly.

—

Restrict Building Plans

WASHINGTON, March 25—All companies that plan building construction or new enterprises or enlargement of industries that are not needed in the prosecution of the war will meet with serious opposition from the Government. Such businesses will be unable to secure labor, material or capital. Power has been given the Secretary of the Treasury to approve or veto new capitalizations.

—

Chicago Accessory Show a Success

CHICAGO, March 25—The third annual motor car accessory show staged last week by Rothschild & Co. was a complete success, not only in attendance, but in amount of business done. Tires, usually one of the biggest items to go at a show, were apparently of secondary importance, and the strongest buying was for storage batteries, anti-glare lenses, spotlights, etc., while body polishes, paints, oils, etc., came next, accounted for by the overhauling season. The special accessory department for Fords, including parts, did a large volume of business.

—

Changes in J. & D. Tire Co.

CHARLOTTE, N. C. March 25—F. Smith, one time Eastern sales manager for the Jeffery Motor Car Co., superintendent of branch houses for the Maxwell Motor Car Co., and until recently secretary and sales manager and one of the organizers of the Briscoe Motor Car Co., is now identified with the J. & D. Tire Co., of this city, in active charge of sales. R. L. DeLissor, formerly branch manager of the Columbia Motor Car Co. and assistant sales manager of the Briscoe Motor Car Co., has been appointed Eastern sales manager. H. O. Smith remains as president and factory manager, with C. M. Downs superintendent in charge of production. The present capacity of the factory is 500 tires a day. Heretofore J. & D. tires have been sold almost exclusively through the South, but arrangements are now being completed to establish sources of distribution in the East and Middle West.

—

Liberty Loan Committee for New York Dealers

NEW YORK, March 25—New York dealers have lined up their Liberty Loan drive committee. Charles M. Brown (Winton) is chairman and he has appointed the following: Charles E. Miller, vice-chairman; R. H. Johnston (White); C. S. Hare (Packard); F. G. Cavill (Marmon); A. G. Southworth (Buick); Charles E. Reiss (Hupmobile); W. A. Woods (Peerless); W. C. Poertner (National); H. J. De Bear (Maxwell); I. M. Uppercu (Cadillac); C. H. Larson (Oldsmobile); C. Lescaris (De Dion); J. F. Plummer (Liberty). J. C. Nichols, Louis Mansbach, W. A. Allen and F. W. White will represent the accessory trade. The tire dealers will work with the rubber trade committee.

—

American Die Casting Reorganized

INDIANAPOLIS, March 25—C. D. Cutting, J. H. Armstrong, R. W. Smith and F. D. Tobin, of the C. A. S. Engineering Co. of Detroit, together with E. Barton Hall, formerly director of purchases of the Curtiss Aeroplane & Motor Corp., have bought an interest in the American Die Casting Co. of this city. The company has been completely reorganized and its capacity tripled. The new officers are: Lawrence Olson, president; E. Barton Hall, treasurer; C. D. Cutting, secretary, and W. L. Jenks, assistant treasurer.

—

Harry Bill Winton Factory Manager

CLEVELAND, March 26—Harry L. Bill has been appointed general factory manager of the Winton company. He was formerly factory manager of the Chalmers Motor Co. and more recently manager of the experimental station plant of the aircraft board at McCook Field, Dayton.

—

Hal Assets Exceed Liabilities

CLEVELAND, March 27—The schedules in bankruptcy of the Hal Motor Car Co. which have been filed in the Federal Court fix the company's liabilities at $222,180.77 and its assets at $232,291.67.

—

Tractor Demonstration for Michigan

GRAND RAPIDS, March 26—The Tractor and Implement Dealers of West Michigan will conduct a public exhibition and demonstration of power farming machinery here on April 23, 24 and 25. Twenty-five acres of land have been obtained, and several shelter tents will be erected, as well as a large tent in which lectures will be given by agricultural experts and county agents.

Car and Truck Prices Increase

Reo Drops 2-Ton Truck—Deering Sets Price—Crow, Baker and Saxon Advance

LANSING, MICH., March 27—The Reo Motor Car Co. will discontinue production of its 2-ton truck. The company has received a contract from the Government for creeper-type tractors, and until the order is completed only one model truck, namely, the ¾-ton light delivery vehicle, will be manufactured. When the Government's needs have been taken care of the Reo company will probably resume production of heavy trucks.

Truck prices will be increased as follows on April 1:

Model	Old Price	New Price	Increase
Complete with body	$1,175	$1,275	$100
Truck chassis.....	1,100	1,175	75

—

$60 Increase on Crow-Elkhart Cars

ELKHART, IND., March 26—The Crow-Elkhart Motor Co. has increased the prices of its models $60, as follows:

Model	Old Price	New Price
2—Pass. roadster	$935	$995
5-pass. touring	935	995
De luxe roadster.....	995	1,055
De luxe touring.....	995	1,055

The price of the sedan was not changed.

—

Price of Deering Magnetic Fixed

CHICAGO, March 25—Prices of Deering Magnetic cars have been definitely fixed by the Magnetic Motors Corp. They are:

Model	Price
7-pass. touring.....	3,950
4-pass. roadster.....	3,950
Coupe	4,850
Sedan	4,950

—

Baker Electric Price Increase

CLEVELAND, March 26—The Baker R. & L. Co. will increase its factory prices on April 1, as follows:

Model	Old Price	New Price	Increase
Brougham ...	$3000	$3150	$150
Coach-type ..	3200	3400	200

—

Saxon Six Advanced $50

DETROIT, March 26—The Saxon Motor Car Co. will increase the factory price of its 6-cylinder touring car $50 on April 9. The new price will be $1,045. The price was increased from $935 to $995 on Feb. 10. The 4-cylinder model has been discontinued.

—

International Harvester Classes

CHICAGO, March 25—The high schools here are co-operating with the International Harvester Co. to train 1500 boys for farm work this summer. The boys receive elementary instruction in the principles and operation of gasoline en-

gines and the adaptation of the engine to farming in the classroom. In the afternoon, the class goes to the display rooms of the International Harvester Co. and receives practical instruction in the care, operation and construction of farm machinery.

The course has been going on for several weeks and will continue until May 1. A. S. Marlow, in charge of the retail farm operative equipment department of the company, takes charge of the classes in the display room, and lectures on tractors.

—

Germany vs. Daimler Co.

AMSTERDAM, March 20—Proceedings against the Daimler Co. on a charge of war profiteering have been started in the Stuttgart Provincial Court, Germany. It is alleged that the company charged German military authorities exorbitant prices, and, despite its excessive profits, recently demanded increased prices. The company claims that its profits are due, not to excessive prices, but to rapid turnover.

—

Wilmington Aid for Truck Trains

WILMINGTON, March 25—The police department of this city has arranged to meet all government truck trains passing through here and escort them over the best route. A motorcycle policeman meets the train at the point of entrance to the city, when notification of its coming is received, and accompanies it to the point of exit. When the trains remain over night, the police take care of the trucks and the Y. M. C. A. houses the men.

—

Build "National Defense Highway" Immediately

WASHINGTON, March 25 — Immediate construction of the "National Defense Highway" from Washington to Annapolis is provided for in a bill introduced in the Maryland State Senate by Senator Metserott. The work of construction is to be commenced at Bladensburg, where the road will connect with the Washington-Baltimore Boulevard. The need of this road as a defense measure is in its connecting the Naval Academy with the Capital. The road will be 30 miles long and will be called the National Defense Highway.

—

To Improve Dixie Highway

DETROIT, March 25—It is planned to start improving the Dixie Highway north of Monroe as soon as the weather permits. The Monroe-Toledo road is the only exit for motor vehicle travel south and east of Detroit, and it has been almost impassable of late.

—

Liberty Hydro-Airplane in Test Flight

WASHINGTON, March 23—The navy hydro-airplane equipped with a Liberty engine made another official test flight here yesterday, accompanied by several other hydro-airplanes. The plane equipped with the Liberty engine quickly outdistanced the others, and the test was announced to be highly satisfactory.

Call 5000 Men for Airplane Work

Draft Registrants in Middle West to Have Thorough Mechanical Training

WASHINGTON, March 25—Five thousand draft registrants will be called this week to assist in the maintenance of America's air fleet. A call has been made for men from Illinois, Minnesota, Iowa and Indiana. A thorough training course in woodworking and gas engine operation and repair will be given these men at 14 educational institutions selected by the Government.

Voluntary induction will be tried, but where the states fail to produce the required quotas, men will be conscripted. Registrants must have at least a grammar school education to their credit. Assignments to duty will be made according to ability shown.

The schools and quotas of each state follow:

Minnesota, 1820 men; 300 to Carnegie School of Technology, Pittsburgh; 500 to University of Cincinnati; 500 to University of Minnesota; 189 to Pennsylvania State College and 330 to University of Pittsburgh.

Illinois, 700 men; 100 to University of Chicago; 200 to Lewis Institute; 100 to Northwestern University; 300 to Bradley Polytechnic Institute.

Iowa, 2200 men; 100 to New York University; 400 to Wisconsin University; 500 to the Auto and Tractor School, Kansas City, and 500 to the Sweeney Auto School, Kansas City.

Indiana, 500 men to Purdue University.

The above schools have been selected following thorough investigation of the country's educational institutions by the Federal Vocational Board.

—

Miller Rubber Selling Treasury Stock

AKRON, OHIO, March 27—The Miller Rubber Co. is offering 6000 shares of treasury stock for sale at par to present holders of common stock in the ratio of one share for every six held. The company is carrying an inventory which is $1,600,000 larger than normal, according to reports, and expects to do a business of between $15,000,000 and $17,000,000 during 1918. The additions being erected to the Miller plant are almost completed.

—

Combat Plane Production Slow

WASHINGTON, March 25—The House Military Affairs Committee in conference with the War Council this week learned that production of combat planes was behind schedule. Contractors have been unable to keep up with the demand, and it is difficult to tell when the scheduled supply will be obtainable.

—

Chicago to Have General Accessory Show

CHICAGO, March 25—The accessory show which was held in the Coliseum last fall and which then was known as the "Ford accessory show" is to be held again this September, but this time the name Ford will be dropped, and it will be a general accessory exposition.

It is expected that it will be held in the Municipal Pier and not in the Coliseum. The pier is much better for show purposes and there is more room.

—

Continue Federal Aid Road Construction

WASHINGTON, March 25—The theory that Federal aid road construction will not be sanctioned during the war has been exploded by the fact that the Government has fixed the price of cement for this work. Cement plants at Hannibal, Mo., and Iola, Kan., are required to deliver cement to the Government at $1.50 a barrel during the first 4 months of 1918.

—

Mid-West S. A. E. Meets

CHICAGO, March 23—A talk on the work of the Signal Corps by Col. L. D. Wildman, chief signal officer, Central Department, U. S. Army, and an illustrated lecture on motion pictures as a selling medium for automotive products by Wm. Lehle, president of the Commercial Motion Picture Mfg. Co., Chicago, comprised the program at the meeting of the Mid-West section of the S. A. E. last evening.

—

Air-O-Flex Re-elects Officers

DETROIT, March 25—The Air-O-Flex Automobile Corp. has re-elected the following officers: President, G. M. Walker, Jr.; vice-president and chief engineer, O. C. Kreis; secretary, Charles D. Lehmkuhl; treasurer and consulting engineer, Robert A. Weinhardt, and general manager, A. B. Hanson.

—

Racine Dealers Have First Show

RACINE, WIS., March 25—The Racine Automobile Dealers' Assn., organized several months ago, held its first annual show in the Municipal Market Building on March 21, 22 and 23, with excellent results. Formerly the shows were conducted under private auspices, and had little support. There were exhibits by 14 dealers and 6 accessory and supply firms.

—

Louis Seguin Dead

PARIS, FRANCE, March 1—Louis Seguin, chairman of the board of the Gnome & Le Rhone Engine Co. and a pioneer in the development of aviation engines, died here on Jan. 7. He was a grandson of Marc Seguin, the French engineer who invented the water tube boiler.

Louis Seguin in 1895 organized the Gnome Engine Co., which developed the Gnome and later the Le Rhone rotary aircraft engine.

—

$188,000,000 for Navy Flying Service

WASHINGTON, March 22—Congress has appropriated $188,000,000 for the flying service of the United States Navy. This is three times the amount of the total appropriations already made for this service, making a total of $248,000,000 for naval flying operations.

France Decides to Market Alcohol

22,000,000 Gallons to Be Sold After the War for Use of Automobiles Only

By W. F. Bradley

PARIS, March 1—Immediately after the war it is the intention of the French Government to put on the market, for the use of automobiles only, a quantity of not less than 22,000,000 gal. of alcohol. This cannot be used alone in the present type of internal combustion engine, and as there is no desire to change the engine to absorb the new fuel, suitable mixtures will have to be made with this alcohol. It is estimated that after the war there will be available a total quantity of 15,000,000 gal. of benzol. The dyeing industries and perfumery makers will require 3,500,000 of this, leaving 11,500,000 available for automobile use. A mixture of 50 per cent alcohol and 50 per cent benzol is suitable for engines as they exist at present with no other changes than slight modifications to the carbureter. The General Omnibus Co. of Paris made use of this mixture for two years with very satisfactory results, only abandoning it owing to the fluctuations in the price of alcohol.

Alcohol Not Soluble in Gasoline

On a 50 per cent mixture the supply of benzol will not be sufficient to absorb all the alcohol available, and it is impossible to mix the alcohol with gasoline owing to the fact that alcohol is not soluble in gasoline. If the two were used together the gasoline would be used up first, leaving a fluid too rich in alcohol to be suitable for the carbureter.

The Paris Compagnie Générale des Voitures, which controls most of the taxicabs of Paris, has discovered, however, that a very suitable mixture can be obtained by 50 per cent alcohol, 25 per cent benzol and 25 per cent gasoline. The benzol will dissolve both the alcohol and the gasoline, making a homogeneous mixture. On this basis the whole of the 22,000,000 gal. of alcohol which could not be absorbed completely owing to the limited supply of benzol can be made use of in present type motors.

Before the war France imported 66,000,000 gal. of gasoline, most of this coming from America. It is estimated that the quantity required during the first year of peace will be 132,000,000 gal., and as the great increase in the use of automobiles in America makes a further supply from the United States somewhat doubtful, the authorities are seeking as far as possible to assure a home supply. There is practically an unlimited supply of alcohol available from France and the French colonies, but as is well known, this fuel cannot be used alone without important modifications in the present type of engine, and it cannot be mixed with gasoline. This reduces the French to a mixture of alcohol and benzol, which is already well known and was used to quite a considerable extent before the war. Under the Government plan, which consists of a State monopoly of alcohol, steady prices will be assured and important users of automobiles will be induced to adopt this fuel. As a compensation and as a steadying influence against variations in the supply of alcohol produced from beets, there is synthetic alcohol now being produced by the calcium carbide factories in the Alps and other mountainous districts of France. By reason of the war these factories have been obliged to enlarge to an enormous degree, and although not able at the present time to produce synthetic alcohol in any great quantities, they would be in position to produce it under very economical conditions on the return of peace.

Before the war France produced comparatively little benzol, and although this fuel was used exclusively by Paris taxicabs most of it was imported from Germany and from England. Since 1914 the gas companies have been obliged to extract the benzol from the coal treated by them. This extraction reduces the calorific quality of the gas, but not, however, to a very serious degree. It is not thought that the Government will allow the benzol to be left in the gas immediately peace conditions return. Supposing only 20 grammes of benzol per cubic meter are withdrawn, there will still be a total supply in France of 15,000,000 gal.

In 1913 France produced 66,000,000 gal. of alcohol at 100 deg.; in 1914 this dropped suddenly to 44,000,000 gal., and in order to meet the shortage purchases had to be made abroad. No figures have been issued for 1916 and 1917, but it is officially stated that for the preparation of powder alone the army consumes 176,000 gal. of alcohol per day.

—

Tank Production Increases

DETROIT, March 26—The United States is going into tank production on a scale hitherto undreamed of, and great numbers of American tanks in several different types for various kinds of fighting are being rushed to completion in many factories in the East and Middle West.

Two hundred men are needed for two New York tank companies. They may be from 18 to 41 years of age, draft age included, and need have no mechanical knowledge. The personnel of a light tank company consists of a captain, 4 lieutenants, 19 sergeants, 27 corporals, 2 cooks and 50 privates. A heavy tank company consists of a captain, 20 lieutenants, 45 sergeants, 43 corporals, 5 cooks and 144 privates.

—

Ford Loses State Tax Lawsuits

DETROIT, March 25—The Ford Motor Co. lost its fight to avoid payment of the California franchise taxes when the United States Supreme Court upheld the local Federal Court. This court had dismissed proceedings of the Ford company to restrain the state from collecting the franchise tax.

200 French Makers at Lyons Fair

Automobile Participation the Main Feature—Gives Evidence of Post-War Plans

By W. F. Bradley

LYONS, FRANCE, March 4—The City of Lyons opened its third annual trade fair this week with 3800 exhibitors, compared with 2614 in 1917. The Lyons fair was inaugurated in direct rivalry to the one at Leipzig, and has been so successful that it is doubtful if the German exhibition will ever regain its importance. It is claimed that last year the value of the business transacted at Lyons exceeded $40,000,000, this being done under adverse conditions of weather and with transport congested to a very serious degree.

Outstanding Feature

The outstanding feature of this year's fair is the automobile participation. Two years ago there were no automobile makers in the Lyons show. Last year the French Syndicate of Automobile Manufacturers officially boycotted the fair by sending an intimation to all its members that they must not take part in the event. The great majority accepted this advice as an order, although Lyons automobile manufacturers refused to be dictated to. The result was that only local firms, such as Berliet, Rochet-Schneider, Luc Court, Zenith, etc., and agents for American cars held stands at the fair.

Different Policy This Year

This year the French Syndicate has adopted an entirely different policy, for not only are 200 manufacturers exhibiting, but the syndicate has its own hall, and it has sent down its general secretary, Henry Cezanne, who was general manager of all the later Paris automobile salons, to be chief commissioner of the motor section of the Lyons fair. This indicates a desire on the part of the whole French automobile industry to prepare as early as possible for after-the-war conditions. It is also an abandonment of the narrow policy of jealousy which sought to kill all other exhibits than the one in the Grand Palais, Paris, and which obviously cannot be held again until after the war.

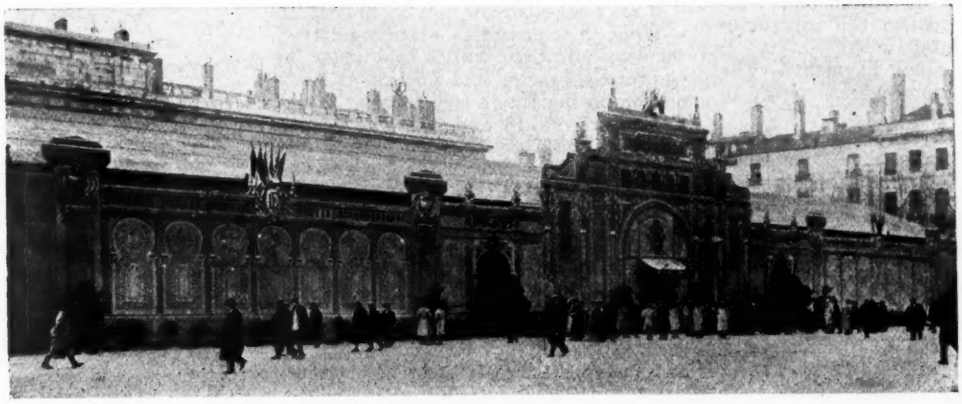
To Erect Permanent Building

As an indication of the permanent success of the Lyons fair, it has been decided to build a permanent building to cost not less than $5,000,0000, capable of holding 5000 exhibitors, and having an area of 1,287,000 sq. ft. Plans of this hall have been prepared and constructive work will begin at an early date.

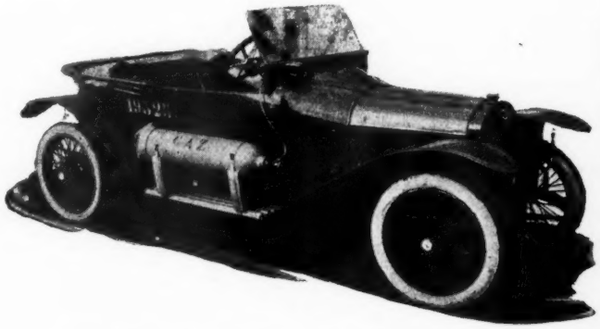
Last year there were exactly 100 exhibits in the automobile section of the Lyons Fair, and the official American stand was at the head of the section. The American exhibits this year were scattered.

The Outstanding Feature of the Lyons Fair—The Automobile Exhibit

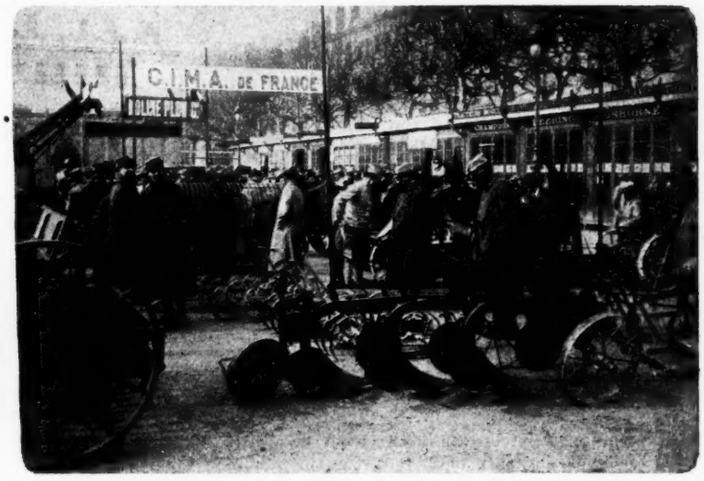
Syndicate of French Manufacturers Has Its Own Hall, Containing 200 Displays



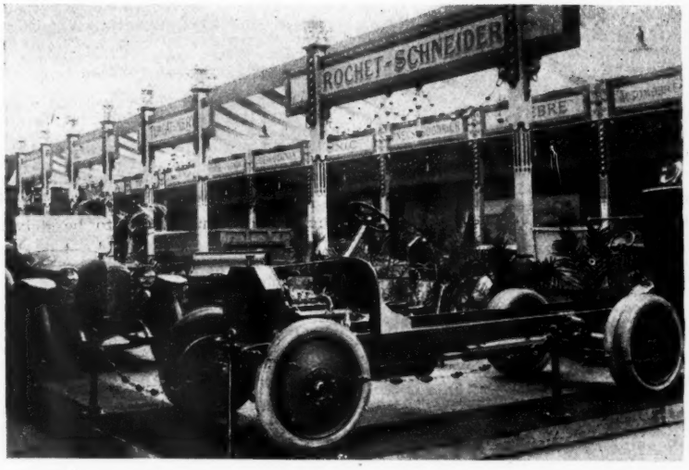
The automobile exhibits were housed in an attractive one-story building, with stained glass windows and clusters of flags at regular intervals



Here is one of the cars fitted with a small tank to run on gas. The registration number is painted on the sides and the cowl



American plows were a source of great interest to the soldiers who visited the fair



The Rochet-Schneider exhibit included a truck chassis, two cars and a body. Note the steel wheels on the truck

Each exhibit was partly roped off, contrary to American custom. Trucks, cars and chassis were exhibited side by side

Gray & Davis, Inc. Pays All Its Debts

BOSTON, March 25—Gray & Davis, Inc., which went into the hands of a creditors' committee Nov. 24, 1916, paid off its last claim Saturday and to-day is free and clear and carrying on a good business.

The total debts to banks and merchandise creditors when the committee was named amounted to $2,550,000. It was paid in 12 equal payments. The period of payment covered only 16 months.

While the company is devoting a large part of its facilities to munitions work the starter and lamp business is still maintained, and last year amounted to $2,500,000.

—

May Embargo Exports to Canada

WASHINGTON, March 27—An embargo or at least licensing of automobiles shipped from the United States into Canada, is being considered by the Canadian War Board. This creates a serious situation owing to the fact that Canada is importing more than $16,000,000 worth of American automobiles a year. At present the National Automobile Chamber of Commerce is endeavoring to counteract the embargo propaganda by education of the public of the value of motor cars by publicity scattered through the civic organizations of Canada. This education campaign has been planned and in operation for several months for officials of the industry here have foreseen the possible transfer of anti-automobile agitation from the United States to Canada.

—

California Tractor Demonstration Covers All Farm Work

SAN FRANCISCO, CAL., March 21.—What is described as educational tractor demonstrations will be held under the California Tractor and Implement Association on the University farm at Davis, Cal., April 17, 18 and 19. The demonstrations and expositions will be entirely educational in character, and will be immediately under the supervision of the Society of American Agricultural Engineers.

The list of the different tractors that are to demonstrate has not yet been made public. The rules covering the demonstration provide for plowing for 1½ hr. each afternoon, harrowing for 30 min. and other activities for 1 hr. The mornings will be given over to private demonstrations and in these all plowing must be at a depth of 8 in.

The rules provide that not more than one tractor of a size and model will be permitted to operate during the public demonstration. Those companies or individuals demonstrating must be members of the California Tractor and Implement Association. Some of the rules governing the demonstrations are as given below.

Studebaker Distributers Take Over Two Branches

SAN FRANCISCO, March 25.—Effective March 15, the C. N. Weaver Co., Studebaker distributer, takes over all the territory of the San Francisco Studebaker branch. This includes northern California as far south as Porterville and the western half of the state of Nevada. The C. N. Weaver Co. has been Studebaker distributer since 1913. C. N. Weaver, president of the company, was formerly an employee of the Studebaker Corp., having been connected with this firm for nearly 25 years. For several years before Studebaker began the manufacture of automobiles he was the manager of the vehicle branch at San Francisco and continued as automobile manager until he took over the dealership in 1913.

At the same time the F. L. Shaw Co., Studebaker distributer at Dallas, has taken over the Dallas branch of the Studebaker Corp. with the exception of the new Mexico territory, which will be transferred to the Kansas City branch.

—

First Standardized War Truck Convoy En Route

WASHINGTON, March 28—The first standardized war truck convoy, which left Lima, Ohio, late last week, is nearing Chambersburg, Pa., and will arrive in Baltimore Friday night. The trip to date has been without a mishap of any kind.

Rules of California Tractor Demonstration, April 17, 18 and 19

1. In the afternoon of each day public demonstrations will be held, divided into three periods as follows:

Plowing	1:30 to 3:00
Harrowing	3:00 to 3:30
Stunts	3:30 to 4:30

Private demonstrations will be held in the mornings on the portion of the field allotted for that purpose, also during the "stunt hour." Each public and private allotment shall be entirely under the control of its owner, except that all plowing must be done to a depth of at least eight inches, measuring the furrow wall. Re-working of ground already plowed in public demonstrations will be permitted on Thursday and Friday mornings and Wednesday, Thursday and Friday afternoons between 3:00 and 3:30.

2. Not more than one tractor of a size and model will be permitted to operate on the field during public demonstration. Extra equipment or slight variation in design are not to be interpreted as distinguishing different size or model. During the public demonstration no tractor will be permitted in operation in any other part of the field.

3. Size of land allotted to each tractor exhibitor for private demonstration and for public demonstration will be determined by the average width of plows which they undertake to pull.

4. All exhibitors will be allotted land in the same field or adjoining fields during each day's demonstration. (It appears on this date, March 16th, that each exhibitor will be allotted one field for private demonstration and one field for public demonstration. The private field will serve for special demonstrations during the mornings, sufficient area being reserved to plow in the public demonstration Friday afternoon. The field allotted for public demonstration will be half plowed on Wednesday afternoon and the other half on Thursday afternoon. This cannot be definitely determined until all entries are in).

5. All plows on any given gang must be set at the same depth and kept there during the demonstration period. This depth must be at least eight inches. Plows found operating otherwise will be ordered from the field for the balance of the day's work.

6. In all public demonstrations the motor of tractor must not be run at more than 10 per cent above its catalog speed.

7. Positions on field first day will be arranged by lot. Each exhibitor will be required to finish his land daily in a workmanlike manner and assist in plowing the end lands as directed by the general manager.

8. Each field will be surveyed and staked ready for each day's demonstration.

9. Each tractor shall bear a placard showing the brake horsepower of the engine, the revolutions per minute, the plowing speed in miles per hour, and the kind of fuel used and its Baume test. Tractors using more than 5 per cent of gasoline shall be classed as burning gasoline and be so placarded.

10. All tractors on the demonstration field belonging to one exhibitor must be kept on or along the land allotted him for that day's demonstration, until the hour designated by the management for returning to headquarters.

11. No machine will be allowed to operate with special equipment other than designed for practical use with same. No spectacular methods will be permitted on the part of salesmen or others to attract crowds. The demonstration must speak for itself.

12. Each tractor exhibitor will have the privilege of burning any kind of fuel he desires but no one will be permitted to burn fuel of a higher gravity test than that used by his competitor burning the same kind of fuel. All exhibitors will be required to obtain fuel from source designated by general manager.

13. Manufacturers will be privileged to make turning tests or tests of drawbar pull of their tractors during any day of demonstration, but if submitting to these tests, which will be conducted by the University of California, they thereby agree that the results may be made public. These tests must be made in forenoons, or following public demonstrations afternoons.

14. The interpretation and enforcing of these rules shall be left to the field manager of the demonstration under the direction of the committee.

15. Each company exhibiting at this demonstration shall appoint one manager who will be expected to report to the general manager not later than 8:30 o'clock each morning for instructions and information regarding the day's work. This manager of exhibits will be held accountable for the work of his company, and no instructions will be issued to any one else, nor will requests, instructions or complaints be recognized from any one but this exhibit manager. He shall wear a badge furnished him specifying his being official exhibit manager.

16. Each exhibitor will be expected to keep plows, tractors, etc., around his tent arranged in first-class order, and the land allotted to him for exhibiting purposes free from circulars, rubbish, etc., such as will be distributed around headquarters daily. They will also be expected to use care at all times in operating machinery in respect to its safety for all visitors. The management will appreciate co-operation of these exhibit managers in all matters.

17. Each entrant will sign the rules and hereby agrees to live up to the rules and co-operate with the committee in every way to make the tractor demonstration a success.

18. No companies or individuals are eligible to demonstrate unless they are members of The California Tractor and Implement Association.

19. It shall be against the rules and regulations for any tractor manufacturer to put on an exhibit on the street corners of the city where the tractor demonstration is held, or to do any other thing in the way of exhibiting machines that would detract from the tractor demonstration and the regular established exhibits in the tents.

20. Exhibitors of machinery to be driven by belt power will be permitted only in the exhibit tent, not in connection with the field demonstration or exhibitors' headquarters tents in the field.

21. During Saturday the members of the Association will come to the campus of the university as guests. A plot of ground will be given to the association, which plot of ground will be at the disposal of the Demonstration Committee. The members of the association are individually bound to comply with the one rule that the university has made—i. e., there shall be no sales efforts of any sort on the property of the University of California on Saturday. All exhibiting members are obligated to see that their entire sales force observes this rule. It will be permissible to take the names and addresses of prospective customers, but it will be against the spirit of this regulation to go further. All exhibiting members are expected to appear in the parade on Saturday afternoon, with every available tractor.

Rumors Exaggerate Airplane Delay

(*Continued from page* 651)

At present the Packard company is producing practically all of the Liberty airplane engines. The Lincoln Motors Co. will be ready within 60 days. Their original schedule called for beginning of production April 1.

It is expected that the three General Motors plants will be in production within the next 30 to 40 days. In other words, all of the companies are rapidly approaching the state which they should have attained from 60 to 90 days sooner, and we should see quantity production of Liberty engines by mid-summer.

The Aircraft Board has for its functions the co-ordination of Army and Navy flying requirements, and operates also as a clearing house for the industrial airplane problems. The real causes for the delay come from the over-optimistic view of manufacturing conditions that was taken a year ago when the airplane program was laid out and before fuel shortages, transportation troubles and difficulties with priorities this last winter were experienced. Every company manufacturing war supplies demanded priorities, with the result that most industries vital to the war suffered. The aircraft officials frankly admit that they did not conceive of the difficulties of the past winter in their program, and that this was the cause of the exaggerated predictions.

Many Reports Misleading

With regard to the recent criticisms published throughout the country of the Liberty engine and the airplane program, it can be said that many of these reports are untrue. For example, in a recent report published in New York City it was said that the Liberty airplane which fell at Mineola suffered the accident because of a broken crankshaft. As a matter of fact, the crankshaft was bent as a result of the fall, and was not the cause of it. It is on view in Washington, and is the proof in itself of the falsity of the report. The real reason for the accident is known in military circles. It is one that does not reflect in any way on the Liberty airplane engine, but which cannot be told here because of the objection of military authorities.

The report that a Bristol plane equipped with a Liberty engine refused to leave the ground at the Curtiss plant at Buffalo did not tell the complete story. It failed to include the fact that minor mechanical troubles such as is often found in a new automobile or motor truck was the cause of the difficulty. When this was remedied, the airplane flew perfectly and is giving excellent service now.

The reports have also dwelt with inefficiency, so-called, at the Curtiss factories. The report stated that the company had failed to produce a single battleplane so far, and that it was producing bombing planes very slowly. It added that the company was 74 per cent behind schedule.

Authoritative statements, made in answer to these charges, say that the Curtiss company is not behind schedule. When it was taken over by the Willys-Overland Co., and negotiated with the Government, it was told to make training planes only, as they were needed most urgently. It entered into training-plane engine tooling and production. More than 1100 training planes have been turned out this month by the Curtiss and Willys-Overland organizations.

Planes Well in Hand

The company has also produced a number of bombing planes, but these have not been finished because the engineers of the Signal Corps, according to company officials, have not yet designed the bombing attachments. The company states that it is ready to produce fighting planes as soon as it gets Government contracts for them.

Snowden Marshall's committee is visiting Buffalo this week, and is making a thorough investigation of the Curtiss plant.

Major-General Leonard Wood before the Senate Military Affairs Committee said that we should use foreign engines in our planes because they have been tried. He criticized the Liberty airplane engine, but investigation here to-day failed to reveal any specific knowledge that he has about the Liberty engine other than that which he obtained abroad. No great importance has been attached to his statements.

The conference to-day developed many other facts. It was shown that 22,000 airplanes are included in our program, of which 7000 will be training planes. Eleven thousand will be made here of three types, including the Bristol machine, which is a two-seater, fast and light, and carries machine guns and photographic equipment but no bombing apparatus. The Day Bomber, which is a general-purpose machine, similar to the de Haviland type used by England, and which carries machine guns, bombing apparatus, photographic equipment, and is used for fighting and scouting both, together with the Night Bomber, capable of carrying heavy loads of explosives and somewhat similar to the huge Caproni with more than one engine and used principally for making night raids, are also included. The remaining 5000 planes in the program are those ordered from France and Italy last August to be furnished directly to our soldiers at the front. Italy, owing to the great German offensive, has been unable to live up to its program and the schedule for this 5000 has fallen somewhat behind.

The greatest problem we will have, according to Howard E. Coffin, will be the question of shipping tonnage. One airplane with its spares requires two crates 7 ft. x 8 ft. x 7 ft. x 40 ft. long each, and it is questionable that the shipping tonnage will be available when quantity production begins. The French Government when we entered the war suggested that we build no airplanes on this side but provide the materials and workers to France and England instead. Reports here indicate that this has been done to a surprising extent and that many thousands of our men are working at allied factories. There are also other reports to the effect that in the near future American-built airplanes will be flying on the battle front that will have been made by American workers out of American material in American factories in France and England. It is also likely in event that shipping tonnage is not available that all of the fabrication work will be done in this country and the assembling abroad.

The Aircraft Board states that there is no trouble at this time either with materials as regards quantities or with labor, although it is very likely that in the near future, when quantity production is reached, there will be a shortage of highly skilled workers.

—

Fuel Oil Distribution Rules Revised

WASHINGTON, March 26—Rules governing the distribution of fuel oil in all districts east of the Rocky Mountains have been revised. By the proclamation of Jan. 31, manufacturers and distributers whose gross sales aggregated more than 100,000 barrels a year were required to obtain licenses from the Fuel Administration. The present revisions govern these licenses.

It was found that under the old rules distributers controlling only a small supply were unable to meet the requirements of all their customers, while those of large distributers were able to meet the needs of all consumers on the priority list. The new scheme provides that the Fuel Administrator may require a distributer to meet the demands of another distributer's customers before he can supply the needs of his own customers not on the preferred list.

The priority list follows:

1. Railroads, bunker fuel and oil refineries using or making fuel oil.
2. Export deliveries or shipments for the United States army and navy.
3. Export shipments for the navies and other war purposes of the Allies.
4. Hospitals where oil is now being used as fuel.
5. Public utilities and domestic consumers now using fuel oil, including gas oil.
6. Shipyards engaged in Government work.
7. Navy yards.
8. Arsenals.
9. Plants engaged in manufacturing, production and storage of food products.
10. Army and navy cantonments where oil is now being used as fuel.
11. Industrial consumers engaged in the manufacture of munitions and other articles under Government orders.
12. All other classes.

—

Takes Over Cell-Beam Sales

NEW YORK, March 27—The Cell-Beam Corp., 501 Fifth Avenue, has been formed to take over the merchandising of the Cell-Beam spotlight formerly manufactured and sold by the Cell-Beam Mfg. Co., Brooklyn, N. Y. The incorporators are: President, Rex W. Wadman; vice-president, Nicholas G. Rost; secretary, J. J. Record.

Urge Motor Trucks for Rural Mail Service

John Blakeslee, Fourth Assistant Postmaster General, Outlines Plans by Which Service and Transportation Facilities Can Be Greatly Improved

WASHINGTON, March 25—The great opportunity for increased use of motor trucks in the rural mail service of all sections of the country was outlined today by John R. Blakeslee, fourth assistant postmaster general, in charge of rural mail delivery. Mr. Blakeslee says there is a 10 per cent reduction in the productivity of the manpower in the vicinity of Washington due to transportation difficulties.

Next winter we will be 10 per cent short of men, and this must be compensated for in some way. An increase in the service offered by rural mail delivery is considered one of the great possibilities.

There are 44,000 rural mail routes in the country and these average but eight pieces per route per day, which is less than 10 lbs. On the return trip the average is less than one piece per route per day. The entire average is less than 1 lb. per day per farm. Mr. Blakeslee sees no reason why, by means of the rural delivery system, the capacity of the farmer should not be increased. Through these channels the produce of the farm can be transported quickly to the place where it is required, and the merchandise from the city can be transported to the farmer, without the farmer's having to go to the market for it. These 44,000 delivery routes offer flexible channels for such work.

No Thought of Efficiency

At present too many of these rural mail routes are laid out without any thought of efficiency. They literally start from nowhere and end nowhere. A rearrangement is necessary so that at one end of the route there will be the town or city market requiring produce which can be brought in by parcel post delivery, and at the other end the productive country areas which can furnish the food supplies for the cities.

To this end, Mr. Blakeslee has been working on experimental rural mail routes which are not circuits but rather out and return routes over the same distance, this plan being adapted to increase trade for a parcels post service both ways.

An example of such a route, and the resulting business over it, is from Lancaster, Pa., to Gettysburg, to Baltimore, Md., a total distance of 105 miles. On the first day, only 56 lbs. of food produce from the farms was collected for the city markets, but after the route had been running 17 days the daily load had increased to 2200 lbs. Soon two motor trucks were necessary to serve it. Before this experiment was tried there was no thought of any necessity for a motor route over this area, as Lancaster possesses ample agricultural facilities to supply its needs. The same is true of Gettysburg and Baltimore. In spite of apparently unfavorable conditions the route has proven very successful, and in addition to parcels post matter, first class mails are carried.

An example of the thoughtlessness in laying out these rural mail routes is evidenced by the fact that from fifty-two of the largest cities in the country there are only 256 important rural routes leading out of these cities, and these rarely lead into the country areas but generally circle through the suburbs. Of these 256, 172 lead out of St. Louis. No rural routes leading into productive farm areas radiate from New York or Philadelphia, although it is from such centers that routes should radiate to make the food supply from the country to these cities more flexible.

Surveys Made

Surveys of rural routes out of such cities as Chicago, Denver, St. Paul, Detroit and Grand Rapids have been made, with the thought of establishing 100-mile routes from these cities into the country and back over the same roads. An example of how such a route works out is Savannah, Ga., where there is a route to Statesboro, a distance of 50 miles. Savannah is the center of a desert so far as food production is concerned, and it is not before you are 25 miles out of the city that you reach the productive area. It is possible with this 50-mile route to tap this productive area and bring farm produce to the city.

Examinations of parcels post shipment have disclosed the fact that much farm produce is taking an indirect road to the market, whereas with the rural motor parcels post system it would go direct.

Examples of Inefficiency

Here is an example: On a parcels post route out of Philadelphia is located the small town of Oxford, which is a great mushroom center, from which 1700 lb. per day are shipped by motor truck to Philadelphia, where they are re-shipped by the postoffice mail system to New York City, Lansdale, N. J., Washington, Baltimore, and other places. If these were transported direct from Oxford to Lansdale by motor it would be a 35-mile trip, whereas the way they are handled at present the distance is 177 miles.

Another example of how the motor rural delivery system could care for this farm-city transportation is the postoffice of New Holland, Pa., which ships 25,000 crates of eggs a week. Many reach New York by an indirect way through the railroad postoffice. This means many handlings. It is possible to send eggs direct from New Holland to New York and deliver them direct to the customer. There is no reason why such delivery direct to the customer should not be made by parcels post or fourth-class mails because it is done with the first-class mails. Sending these eggs through the regular postoffice channels requires twelve handlings where one should suffice.

Shipping 30 crates of eggs from Vineland, N. J., to New York now requires fourteen handlings. The cost of the eggs is doubled by the cost of the operations in transit. The time consumed between the farmer and consumer is more than doubled, and yet the distance is less than 100 miles. If motor trucks in the parcels post organization traveled between Vineland and New York, the operations of handling the eggs would decrease to two. The time for shipment from Vineland to New York would be slight. One motor truck could haul fifty crates of eggs direct from Vineland to New York in a day. At present the weight limit of any parcels post package is 70 lb. This permits shipment of a bushel of potatoes, which weighs 62 lb. or a crate of eggs, which weighs 52 lbs.

At present there are 8 different rural routes operating on this system. Some of them have one and others two trucks. They operate so as to cover the route each way once a day. If the route is short one truck makes a return trip. If it is too long for this, two trucks are used, one starting from each end of the route each day. The routes are as follows:

Route 1—Philadelphia to Atlantic City, 107 miles. A truck leaves each end each day. They meet at Vineland, midway.

Route 2—Baltimore to Solomons, Md., 92 miles. A truck leaves each end daily, but the one leaving from Solomons waits until the one from Baltimore has arrived.

Route 3—Washington, D. C., to Leonardstown, Md., 55.7 miles. Two trucks make the round trip each day, starting from opposite ends.

Route 4—Washington to Baltimore, 76 miles. The two trucks start from opposite ends and meet at Mt. Airy, where they turn, and exchange loads as necessary.

Route 5—Lancaster to Baltimore, 105 miles. Two trucks, one from each end, meet at Gettysburg, where they exchange loads and return over their respective routes.

Route 6—Baltimore to Philadelphia, 116 miles via Oxford. A truck leaves each end. They meet at Oxford, where they return over their routes. Oxford has a population of 2,390.

Route 7—Savannah, Ga., to Statesboro, Ga., 55.5 miles. One truck makes the trip out one day and back the next.

Route 8—Columbus, O., to Zanesville, O., 55 miles. One truck makes the round trip daily.

The capacities of the trucks used on these eight routes approximate 1½ tons. Most of them have pneumatic tires, 36 x 6 in. There is one man on a truck who looks after the mail, as well as the parcels post. Regular parcels post rates are charged and the driver can collect packages from one point and deliver them to another point on that route without the parcels having to go into a postoffice. He carries the necessary stamps and has the power to cancel them. In fact he transacts a regular postmaster business while on the truck.

The first of these routes with the exception of two Maryland routes which were already in operation, was started in December, 1917.

American Cars Popular in Southern France

Excellent Methods of Sale and Low Prices Made the Demand for United States Products Increase Rapidly Before the War

MARSEILLES, FRANCE, March 1—Prior to the war, the demand in the French Mediterranean region for American automobiles increased steadily and rapidly, due to excellent methods of sale and low prices, according to consular reports. It is believed that the demand will continue after the war.

There were approximately 8000 motor vehicles here, of which only a few hundred were trucks. The countries which sold cars in this region included the United States, Italy, Switzerland and England. A few German cars and certain French makes were also popular.

French roads are excellent, and cars are not subject to the same strain as are those in many parts of America. Therefore the cars that French manufacturers produced and sold here were not as strong as American cars, but were more economical, selling for an average of 8000 francs ($1,544) to 9000 francs ($1,737). In addition they conformed with the French tendency to have a small bore and long stroke.

The two types of cars that have had considerable success here are 5-7 and 12-16 hp. The details of these and of a popular truck follow:

Model	5-7 hp.	12-16 hp.	Truck 32.5
Capacity	2-pass.	4-pass.	5-ton
Bore and stroke	2½x4¾	3x5	4⅛x5
Speeds	3	4	..
Tread or gage	45.275	49.212	..
Cylinders	2	4	4
Control	right side	right side	right side
Body	Torpedo	Torpedo	..
Upholstery	Buff lea.	Buff lea.	..
Wheelbase	123 in.	130 in.	..
Price	$917	$1,408	$3,281

To obtain satisfactory results, American companies desirous of entering this field should appoint a general agent at Paris with the power of appointing subagents throughout the provinces. The central depot should carry a full line of cars and trucks, as well as parts. The last item is especially important, as purchasers hesitate to buy a foreign car for which parts are not available.

A general agent in Paris is in a better position than the manufacturer to select efficient representatives in provincial centers. Furthermore, he is always in close touch with his subagents and can confer with them in regard to local requirements. He should also be able to organize a publicity campaign, which can be directed more easily from Paris, and he should take steps to participate in all shows, exhibitions and contests. In respect to obtaining orders from the French government an agent in Paris is of great value.

Cars Obtained on Consignment

Such agents usually obtain cars on consignment, paying a deposit on order, and the balance when the car is sold. They are sometimes required to guarantee a certain number of sales a year. Manufacturers give the agents a commission of 20 to 30 per cent of catalog prices, to cover expenses of advertising and commissions of subagents.

A guarantee of the car for at least a year is often required.

At present it is impossible to ship vehicles other than heavy trucks to France. Nevertheless it is advisable for American manufacturers to negotiate with agents, so as to be ready to enter the field when importation is permitted.

Trucks of 2 to 4 tons will be in the greatest demand after the war. Light delivery wagons will also grow in popularity. Chain drive seems to have the preference in this district, with the gear box located on the right side, and 3 or 4 speeds. Automatically regulated air admission to carbureters is usually required, due to severe climatic conditions. Lighting should be electric and the trucks should be equipped with plain or grooved band tires and towing hooks for trailers.

Each automobile of foreign make, before it can be placed in general use, must be accepted by the "Service des Mines" at which time it receives a registration number. Before a car can be accepted, a demand must be made on stamped paper, accompanied by specifications of the car, in French.

—

Cook Elected President of Lane Truck

KALAMAZOO, MICH., March 25—M. H. Lane has resigned as president and general manager of the Lane Motor Truck Co., and is succeeded by W. A. Cook, formerly with the Indiana Truck Co., Marion, Ind., who will also be chief engineer. W. W. Lang of Kalamazoo is vice-president, and L. W. Hamilton is secretary, treasurer and general manager.

The capital stock of the company has been increased from $25,000 to $250,000. The output for 1918 is proceeding on a basis of 600 trucks of 1½, 2½ and 3½-ton capacity. During 1917 the company built and sold 107 trucks.

—

3000 Cars Coming from Pan-American

DECATUR, ILL., March 25—The Pan-American Motors Corp. has announced that it will turn out 3000 cars during 1918.

Automotive Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Net Ch'ge
*Ajax Rubber Co.	51	53	—1
*J. I. Case T. M. Co. pfd	84	88	+1
Chalmers Motor Co., com	6	8	+2
Chalmers Motor Co. pfd	30	40	..
*Chandler Motor Co	82	84	—1
Chevrolet Motor Co	114	116	—5
*Fisher Body Corp. com	32	35	—1
*Fisher Body Corp. pfd	76	80	—7
Fisk Rubber Co. com	50	53	..
Fisk Rubber Co. 1st pfd	98	103	..
Fisk Rubber Co. 2nd pfd	70	75	..
Firestone Tire & Rubber Co., com	95	96	—2
Firestone Tire & Rubber Co. pfd	97	98	—1
*General Motors Co. com	117	118½	—6½
*General Motors Co. pfd	81	82	..
*B. F. Goodrich Co. com	43	44	—1
*B. F. Goodrich Co. pfd	93	99	—1
Goodyear Tire & Rubber Co. com	135	138	—3
Goodyear Tire & Rubber Co. pfd	97	98	—2
Grant Motor Car Corp.	3	4	..
Hupp Motor Car Corp. com	3	3½	..
Hupp Motor Car Corp. pfd	82	90	+7
International Motor Co. com	20	25	+3
International Motor Co. 1st pfd	51	56	+1
International Motor Co. 2nd pfd	22	27	+2
*Kelly-Springfield Tire Co. com	42	43	—2½
*Kelly-Springfield Tire Co. 1st pfd	75	85	..
*Lee Rubber & Tire Corp	13	14	+ ½
*Maxwell Motor Co., Inc., com	27	28½	—1
*Maxwell Motor Co., Inc., 1st pfd	57	58½	—1½
*Maxwell Motor Co., Inc., 2nd pfd	21	22½	—2
Miller Rubber Co. com	125	130	—3
Miller Rubber Co. pfd	96	98	..
Packard Motor Car Co. com	95	100	..
Packard Motor Car Co. pfd	89	92	—1
Paige-Detroit Motor Car Co	17½	20	..
Peerless Truck & Motor Corp	15½	16½	— ½
Portage Rubber Co. com	109	110	—2
Reo Motor Car Co.	17½	19	..
*Saxon Motor Car Corp.	7	9	— ½
Standard Motor Construction Co	10¾	11¼	— ¾
*Stewart-Warner Speed. Corp	56	57	+1
*Studebaker Corp. com	44½	46½	— ½
*Studebaker Corp. pfd	..	94	..
Swinehart Tire & Rubber Co	22	35	..
United Motors Corp.	26⅜	26½	—1⅞
*U. S. Rubber Co. com	54½	55½	+ ½
*U. S. Rubber Co. pfd	101	103	+1
*White Motor Co.	42	43	— ½
*Willys-Overland Co. com	17	18	— ¾
*Willys-Overland Co. pfd	80	81½	— ½

*At close March 23, 1918. Listed N. Y. Stock Exchange.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net change
Auto Body Co.	7	8	..
Bower Roller Bearing Co.	..	18¼	..
Chevrolet Motor Co.	115	120	—2
Commerce Motor Car Co.	..	10½	..
Continental Motor Co. com	5⅜	5⅝	— ¼
Continental Motor Co. pfd	..	..	..
Edmunds & Jones com	..	..	..
Edmunds & Jones pfd	..	..	..
Ford Motor Co. of Canada	205	..	..
Hall Lamp Co.	13½	14	— ½
Michigan Stamping Co. com	12⅞	13¾	+ ⅜
Motor Products	..	..	..
Packard Motor Car Co. com	..	97½	..
Packard Motor Car Co. pfd	89	90¾	—7
Paige-Detroit Motor Car Co	..	18¼	..
Prudden Wheel Co.	..	12½	..
Reo Motor Car Co.	16⅛	16⅝	—1¼

INACTIVE STOCKS

Atlas Drop Forge	..	27¼	..
Kelsey Wheel Co.	86	93	..

Industrial Review of the Week

A Summary of Major Developments in Other Fields

Iron and Steel Prices To Continue 3 Months

The President announced on Tuesday that the agreed prices on iron and steel products would be continued for three months beyond March 31, except that basic pig iron and heavy melting steel scrap would be reduced $1 in April. This means, as foreshadowed in this review last week, a maximum price of $32 at furnace for basic iron, $35.20 for Bessemer iron, or a reduction of $1.10 a ton, and $29 instead of $30 for heavy melting scrap.

It was argued by the Government representatives that the high costs of January and February were due to an unparalleled combination of misfortunes, and should not be thought of as a basis for price advances. The board answered the strenuous plea of certain plate mills for an advance above 3.25c. for their product by the $1 reduction in basic iron and scrap, their main raw materials.

Scant consideration was given to the request of the steel manufacturers that in the interest of the whole trade, including consumers, the prices fixed be given a life of six months or more. The War Industries Board frankly favors lower prices, and it is understood that only the wretched showings of January and February saved the schedule from general reduction at this time.

The old-material trade, which has been in a turbulent state since Government control began, is further upset by the reduction so easily put through at last week's conference, in which scrap dealers were unrepresented. The proposal so long and strongly urged that buyers of scrap be allowed to pay dealers 3½ per cent commission seems to have been jostled aside by the main issues.

The Washington meeting only added to the quietness that has been noted in the market throughout the month. The uncertainty as to the amount of steel war demands will leave for general consumption has changed into uncertainty as to the amount of ordinary business that will remain to make demands upon the steel mills.

Fabricating firms are surprised almost weekly by calls for estimates on some Government building of unusual size. There is apparently no end to the number of enormous warehouses going up.

The effort of the Shipping Board to get ships from the manganese ore trade with Brazil is a matter of concern to the entire steel industry. The development of supplies proceeds slowly.—*Iron Age.*

A New Service

¶ Herewith AUTOMOTIVE INDUSTRIES *supplies for the benefit of its readers a general summary of important developments in other fields of business. This is rendered possible by the editorial co-operation of leading industrial publications which are recognized authorities.*

By compressing the general industrial situation into this form we hope to give our readers a clear and comprehensive idea of up-to-the-minute developments which they could otherwise secure only with considerable expenditure of time and effort.

Fuel Zoning Plan and Prices Finally Announced

The long-awaited zoning plan has at last been announced by the Fuel Administration, as have also new price rulings in a few producing districts. The country has been divided into a number of producing zones within which consumption will largely be confined. In this way thousands of miles of long cross-hauls will be eliminated, thus making for an increase in car utility. A reduction in anthracite shipments to the West and Northwest has also been announced by the Fuel Administration.

Transportation facilities are still bad, the sidings in and around many collieries being congested with loaded coal cars. Considering the urgent need existing for coal, the situation cannot but be viewed with alarm. Bituminous has suffered a tremendous falling off in production, many mines being compelled to shut down because of insufficient empty cars to load. During March there was little improvement. If this condition is not remedied soon it will be exceedingly difficult for the operators to preserve intact their working organizations.

The heavy requirements for steam coal preclude any let-up in the demand. Shippers have not been in position to guarantee plenty of coal, and buyers have been ready to purchase every ton available. Here and there coal is still being confiscated by the fuel authorities for the use of public utilities which do not seem able to get an adequate supply from their regular sources. Retail dealers report many orders.—*Coal Age.*

Ford Tractor Production Plan Unchanged in Growth

(*Continued from page* 624)

A small section of the machineshop is given over to the magneto department. Here some of the sub-assemblies of the magneto are made preparatory to the general assembly processes. Another part of the machineshop is taken up by the tool room, which extends along the inside wall.

Parts leaving the machineshop pass to the assembly shop, where the transmission units are put together in one part and the engine units in another, the two coming together at the final assembly nearest the shipping platform. This assembly work will eventually be done on a sort of carrier or belt system, the same as in use in large motor car factories. At the present time the carriers used are simply wheel trays which run on rollers inside of the two channel beams which are arranged parallel to each other in the form of a track. Thus the production travels a sort of semi-circular path, starting at the foundry and stockroom, passing around through the machineshop and out the assembly shop to the loading platform, or dock.

There are a number of miscellaneous departments which have been placed in close proximity to the other plants, and these are also indicated on the map herewith. For instance, the heat treating room is next to the productive stockroom. The heat treating furnaces and carbonizing furnaces are arranged along opposite walls, allowing the work to be fed into them from the center. The same method is used in connection with the babbitting and blacksmith shop, which are on the side wall, allowing the material to be fed from the open space in the center of the room. A special room is used for magneto heat treating.

The pattern shop is at present located adjacent to the assembly shop, but will probably be changed shortly. Both metal and wood patterns are taken care of in the one department.

A new section is being added to the power house. A large gas producer has been installed, and the wheels are being put up around the producer, which is already in position. This will complete the power house to an extent necessary to take care of the growing production. The accompanying illustrations tell the story of the building work which is going on and give an idea of the remarkable manner in which plant increases and production increases are being made at the same time. Urgent orders are being filled, a shipment of twenty-five a day being required, starting April 1, to fill the order for 1000 which the Michigan State authorities recently gave the Ford company, and twenty-five a day are to be turned over to Canada to fill an order by the Canadian government. Another large commonwealth is reported to be negotiating at the present time to place a large order for these tractors with the company.

Men of the Industry

Changes in Personnel and Position

Kepperly Succeeds Morgan as Curtiss Vice-President

DETROIT, March 22—James E. Kepperly has been appointed general manager of the Curtiss Aeroplane & Motor Corp., Buffalo, succeeding William A. Morgan. Kepperly has also been elected vice-president, a member of the executive committee and a voting trustee. He has been associated with Willys interests for some time, and is vice-president and counsel of Willys-Overland, Inc.

—

A. B. Walton, formerly sales manager of the Master Carburetor Co., Los Angeles, has received the commission of captain in the ordnance department.

—

W. J. Carr, for 2 years purchasing agent of the Falls Machine Co., Sheboygan Falls, Wis., has become associated with the purchasing department of the Aluminum Castings Co., Cleveland.

—

W. O. Rutherford, sales manager of the B. F. Goodrich Co., Akron, has been elected vice-president of the company.

—

Edward Hutchins, formerly supervising engineer of the Federal Rubber Co., has been elected vice-president of the Gillette Rubber Co., Eau Claire, Wis.

—

W. T. Edwards, formerly with the battery division of the Intermountain Electric Co. of Utah, has been elected president and general manager of the Edwards-Warden Motor Parts Co., Salt Lake City.

—

Gould Allen has resigned his position as sales manager of Fuller & Sons, Kalamazoo, Mich., and has been appointed manager of the Detroit office of the Wetzel-Hall Co.

—

L. A. Closter has been appointed district manager of the Federal Motor Truck Co., Detroit, for Michigan, Indiana, Ohio, Kentucky, West Virginia and western Pennsylvania. He was formerly associated with the Centaur Motors, Inc.

—

Gustavus Sickles has been appointed sales manager of the Sullivan Motor Truck Corp., Rochester, N. Y.

—

Ernest T. Conlon has become district factory representative of the Reo Motor Car Co., Lansing, in the Southwest after 3½ years as executive secretary of the Automobile Business Assn. of Grand Rapids.

Harry F. Prescott has been appointed sales manager of the Disco Electric Mfg. Co., Detroit. He was formerly connected with the sales department of the Saxon Motor Car Co.

—

Donald W. Douglas, formerly aeronautical engineer in the aviation section of the Signal Corps, has been appointed chief engineer of the Glen L. Martin Co., Cleveland.

—

Raymond V. Morris has been appointed general manager of the Savage Tire Co. and the Savage Tire Corp., San Diego, Cal., and will have complete charge of all the activities of the Savage companies. He was formerly connected with the Curtiss Aeroplane & Motor Corp.

—

O. S. Comer has been promoted to the position of assistant to the foreign sales manager of the J. I. Case T. M. Co., Racine.

—

W. E. Perrine, production manager of the Standard Parts Co., Cleveland, has been promoted to the position of assistant general manager and chairman of the executive board. He will carry on the work of Christian Girl.

—

W. A. Cluff, who for some time has been auditor of the Mason Tire & Rubber Co., has been elected to the board of directors. He has also been appointed first assistant treasurer.

—

C. J. E. Leach has been promoted to the position of manager of the New York State branch of the Massey-Harris Harvester Co., Batavia, N. Y. He was formerly manager of the Kansas City branch.

—

Clifford A. Williams has been appointed director of sales of the Kissel Motor Car Co., Hartford, Wis. He has directed several merchandising campaigns.

—

O. L. Blanchard has been appointed district manager of the Fruehauf Trailer Co., Detroit, and will have charge of sales in the eastern, southern and middle-western states.

—

Wayne Murray has been appointed general manager of the L. J. Robinson Co., Detroit, Michigan distributer for Maxwell and Chalmers cars. He was formerly Nash distributer in Chicago.

—

General Tire & Rubber Changes

AKRON, OHIO, March 18—The General Tire & Rubber Co. has made several changes in its sales organization. H. E. Taylor has been shifted from the position of representative in Indiana and Illinois to that of Chicago district manager. C. H. Bemis will succeed him in Indiana, and Howard F. Smith has been appointed special representative.

New Companies Formed

Latest additions to ranks of Automotive Industries

Make Trucks and Tractors Under Bollstrom Patents

DETROIT, March 23—The Bollstrom Motors Co. has been organized with authorized capital of $3,000,000 to manufacture trucks and field tractors under the Bollstrom patents. The company has bought 55 acres and leased another 100 acres in Marion, Ind., and will erect a plant immediately. Guy Hamilton has been appointed general manager.

—

To Make "Farm Boy" Tractor

COLUMBUS, OHIO, March 23—Plans have been completed for the organization of a $1,000,000 tractor company to manufacture the "Farm Boy." This tractor is at present being made by the McIntyre Mfg. Co., which organization will be absorbed by the new company. The present capacity will be doubled immediately, and the output, which has been entirely contracted for by France, will be increased.

—

To Make Boring Tractor

ROCKFORD, ILL., March 23—The Boring Tractor Corp. has been organized here to make a new type of farm tractor invented by Charles E. Boring. This will be a 2-wheel model and carry the plow between the drive wheels. The incorporators are J. F. Carpenter, C. B. Williamson, C. E. Boring and F. C. Ricard.

—

Trucks Coming from Salt Lake City

SALT LAKE CITY, March 23—The Wilson Motor Co. has been incorporated to manufacture Wilco trucks, and has bought the building and machinery of the Dickinson Automatic Governor Co. Production has already been started, and the first delivery will be made about April 15. It is planned to turn out 25 one-ton trucks a month. George S. Wilson has been elected president, H. C. Sillett treasurer and W. Daniels secretary.

—

Makes Gasoline from Gas

SALT LAKE CITY, March 23—The Hope Engineering Co. has started work on extracting gasoline from gas. The company has gas wells with an output of 15,000,000 cu. ft. a day, and the capacity of the plant is at present 6,000,000 cu. ft. a day. One and a half gallons of gasoline is made from every 1000 cu. ft. of gas. The initial cost of the Hope Engineering plant was $500,000. Additional wells have been purchased, and these will be used later.

Durant Sells Interest in California Chevrolet

OAKLAND, CAL., March 25—W. C. Durant has disposed of his interest in the Chevrolet Motor Car Co. of California. The deal involves, it is claimed, about $1,000,000, and places the control of the plant in the hands of Norman De Vaux, president of the company, and R. C. Durant, son of W. C. Durant, who has been general manager of the company for the last year. The capital of the Chevrolet Motor Car Co. of California has been increased to $1,500,000, all paid in, and production will be increased.

—

Spranger Wire Wheel in New Plant

DETROIT, March 25—The Spranger Wire Wheel Co. is now in production in its new factory. The building is on a 5-acre tract of land and is 250 x 160. The company's production is 125 sets of wheels a day, of which 75 per cent is for the Government. Two new types of wire wheels are being tested, and it is expected that production of one of them will start in June.

—

New Plant for Hackett Motor

JACKSON, MICH., March 25—The Hackett Motor Car Co. has started work on the first unit of its Burlingame plant. It is planned to have this ready within 60 days, and to double the present capacity within 6 months. The new plant will be used for assembling, body-building, painting and upholstering.

—

Central Rubber Moves to Defiance

AKRON, OHIO, March 22—The Central Rubber Co. has purchased the building formerly owned by the Diamond Glass Co., Defiance, Ohio, and is preparing to move its plant to this city. The company will employ about 150 men.

—

Factory for Landers Bros. Co.

TOLEDO, March 25—A factory is being erected by the Landers Bros. Co., where fabrics will be coated and rubberized for automobile tops and side curtains. Fifty men will be employed. R. E. Landers is president of the company.

—

Overland Drive-aways Break Records

TOLEDO, March 25—Recent drive-aways at the Willys-Overland plant have broken all previous records. Last month 2938 cars were driven across country.

—

Niles Car Plant Sold

NILES, OHIO, March 20—The Niles Car & Mfg. Co. has sold its truck factory to the Niles Motor Truck Co. of Pittsburgh.

—

Reo Drive-aways Increase

LANSING, MICH., March 26—Drive-aways from the Reo Motor Car Co. are steadily increasing. Three weeks ago 8 per cent of the production was driven away; 2 weeks ago the percentage increased to 18, and last week it was 28 per cent. A few days ago 26 speed wagons (¾-ton trucks) left for Atlanta, Ga., and a train of 10 speed wagons and passenger cars went to Charleston, S. C.

Current News of Factories

Notes of New Plants—Old Ones Enlarged

—

Leonard Tractor Co. in Canada

JACKSON, MICH., March 23—The Leonard Tractor Co. of Canada, Ltd., has been organized as a subsidiary of the Leonard Tractor Co. of this city. The Canadian company will build 2500 tractors during 1918, according to H. M. Leonard, president of both organizations. The exact location of the plant has not been decided on yet.

—

Increases of Capital

AKRON, OHIO, March 23—The Mohawk Rubber Co. has increased its capital from $1,050,000 to $2,050,000.

—

DETROIT, March 23—The Fruehauf Trailer Co. has increased its capital from $100,000 to $150,000. The production of trailers has been doubled during the last 2 months, the present output being 35 a week.

—

MILWAUKEE, March 25—The Industrial Controller Co., manufacturer of electric controlling devices, has increased its capital stock from $100,000 to $150,000. A shop addition was recently completed and placed in service.

—

Dividends Declared

The Locomobile Co. of America has declared a regular quarterly dividend of 1¾ per cent on preferred stock, payable April 1 to stock of record March 20.

—

The Hupp Motor Car Corp. has declared a regular quarterly dividend of 1¾ per cent on the preferred stock, payable April 1 to stock of record March 20.

—

The Mason Tire & Rubber Co. has declared a regular quarterly dividend of 1¾ per cent on preferred stock, payable April 1 to stock of record March 20.

—

The Hendee Mfg. Co. has declared a dividend of 1¾ per cent on preferred stock, payable April 1 to stock of record March 20.

—

The General Motors Corp. has declared a regular quarterly dividend of 3 per cent on common and 1½ per cent on preferred stock, payable May 1 to stockholders of record April 15.

—

The Chevrolet Motor Co. has declared the regular quarterly dividend of 3 per cent on common stock, payable May 1 to stock of record April 15.

Nelson Truck Co. Buys Saginaw Motor Plant

SAGINAW, MICH., March 25—The newly organized Nelson Bros. Truck Co., which has a capitalization of $300,000, more than half of which has been paid in, and which is to manufacture the Jumbo 2½-ton truck, has purchased the plant of the Saginaw Motor Car Co. According to schedule, production of one truck a day will be under way within a few weeks, and will be increased as rapidly as necessary additional mechanical equipment can be installed and skilled labor obtained. The company plans to erect a permanent factory as soon as building prices drop to a lower plane.

The officers of the company are: President, Harry B. Nelson; vice-president, Clarence A. Nelson; secretary and treasurer, Clinton J. Nelson.

—

New Company Buys Rush Motors

PHILADELPHIA, March 25 — The Rush Motors Corp. has been formed and has taken over the stock of the Rush Motor Truck Co., which it purchased at the receiver's sale. The new company has obtained the building formerly occupied by the Bourne Magnetic Truck Co and will continue the production of Rush trucks as well as service for those now in operation.

—

Yale Eight Discontinued

SAGINAW, March 25—The Saginaw Motor Car Co. has discontinued the manufacture of the Yale Eight and has sold its entire plant to the Nelson Bros. Truck Co., Saginaw. The Puritan Machine Co. of Detroit has purchased the service stock of the company.

—

Reo 4-Cylinder in Production

LANSING, MICH., March 20—The Reo Motor Car Co. has started production on its new 4-cylinder model. Within 3 weeks the company expects to be making 75 daily. Driveaways during the past week have been reduced 50 per cent, due to heavy rains.

—

Gasoline Stolen from France

PARIS, March 1—To be able to steal 30,000 gal. of gasoline in a country where every drop is rigorously controlled, and where the utmost restrictions prevail, indicates a wonderful amount of ingenuity on the part of the thief. The person who has been able to elude the scrutiny of the inspectors and at the same time rob the State and her employers is a woman employed by the Deutsch Co. in Paris. This woman, whose duty it was to control the vouchers issued by the police for the delivery of gasoline to authorized persons, found some means of retaining these vouchers, instead of handing them back to the police headquarters, and later of delivering them to gasoline retailers. In this way the voucher was made use of twice. The retailers got delivery of gasoline on these stolen vouchers and sold this

fuel to private individuals not provided with a permit to purchase. It was a profitable investment, for instead of selling at $9, these retailers sold at $15. After a discrepancy in the accounts to the extent of several thousands of gallons, an inquiry was made and the woman primarily responsible was arrested, together with several of the retailers who had made use of the stolen vouchers.

—

Promote Brake Inspection Idea

TRENTON, N. J., March 25—The Thermoid Rubber Co. is promoting a brake inspection campaign throughout the United States with the object of inducing car owners to inspect their brakes, and if they are not up to par have them relined. Endorsement of the idea has been obtained from various authorities and the idea is being promoted in the company's advertising.

—

Ford's Milwaukee Men Find Work

MILWAUKEE, March 25—More than one-half of the entire working force of the Milwaukee plant of the Ford Motor Co. already has obtained employment elsewhere, and by April 1 only the accounting and service force will be left intact. The plant will be closed until Aug. 1 or later, as a result of the 40 per cent reduction in Ford output. Many of the men have obtained employment in the plant of the A. O. Smith Co., Milwaukee, maker of pressed steel frames, parts, etc., and others have been placed with Ford plants in other cities.

—

New Ohio Drive-Away Route

TOLEDO, March 25—A new route through Ohio for drive-aways has been announced by the Lincoln Highway Assn. It is via Toledo, Fostoria, Bucyrus, Mansfield, Olivburg, Ashland, Canton, East Liverpool and Beaver, Pa., to Pittsburgh. The route out of Detroit via Lima, Springfield, Columbus, Ohio, and Pittsburgh, following part of the national Old Trails road, has been rendered impassable by the collapse of the Ypsilanti bridge.

—

Government Contract for Workmen's Homes

KALAMAZOO, MICH., March 27—The United States government has awarded a $2,000,000 contract to the O. W. Rosenthal Co. for the erection of housing facilities in the River Rouge district where Henry Ford's shipbuilding plant is located. Homes for about 6000 workmen will be erected, and it is planned to have them ready about June 1.

—

"Car in Transit" Sign Not Accepted

DETROIT, March 26—Sixty Oldsmobiles being driven overland via the Lincoln Highway were held up at York, Pa., for not having license tags. The "Car in Transit" signs the cars bore were not accepted. The New York distributer to whom these cars were consigned met an additional expense of $720 for the complete set of license plates, fines, salaries and expenses of the men while idle.

War Board Restricts Imports

List of 82 Products Includes Cars, Asbestos, Graphite, Acids, Nickel and Zinc

WASHINGTON, March 22—The War Trade Board, through its Bureau of Imports, has published the first list of restricted imports, containing some 82 products, most of which are but remotely connected with the automobile industry. Among those more closely allied with the automobile industry are asbestos, cars, carriages and other vehicles, plumbago or graphite, all acids, nickel and zinc.

Hereafter licenses to import these products will not be granted except (1) when they have actually been shipped prior to April 15, 1918; (2) when coming by rail from Mexico or Canada, or (3) when coming as a return cargo from a convenient port and where their exportation is not specifically prohibited by American Allies.

The list has been issued under the Trading with the Enemy Act, by the terms of which the President on Feb. 14 issued a proclamation which required licenses for all exports and imports. The purpose of the measure is to conserve shipping space, and it is estimated that approximately 1,500,000 tons of cargo space will be saved in the 7½ months' period ending October, 1918.

At present there is a good supply of asbestos on hand, this being used chiefly for insulating purposes in steam installations. Probably between 80 and 90 per cent of the asbestos imported comes from Canada, and but a very small percentage of this is used directly in the automobile field. There is sufficient graphite on hand to last 6 months. About 10 per cent is used for lubricants and from 65 to 75 per cent for crucibles. Only the larger automobile manufacturers use these crucibles, and it is stated that they will not feel the restriction. Most of the graphite comes from Ceylon and Madagascar. The graphite people are sanguine that when licenses for imports are necessary they will be forthcoming.

The list which has been issued is essentially a list of non-essentials in that it includes only those products of which the United States already has an adequate supply to last a long time or which are now being produced here in sufficient quantity to take care of our needs.

—

Industrial Development in Canada

DETROIT, March 25—Figures compiled by the Ontario Motor Car Co., Ltd., Toronto, Ont., and published by the Packard Motor Car Co., show the industrial development of Canada in every line. Savings on deposit with Canadian chartered banks totalled $985,790,000 in 1917, an increase of 20 per cent over 1916. Bank clearings increased 15 per cent. Canada's production has also increased, the value of the crops being $1,089,000,000 in 1917 as compared with $886,494,000 in 1916 and $638,580,000 in 1914. Numerous munitions and ordnance plants were built and equipped last year, including the British Forgings and Aeroplanes, Ltd. The number of automobiles in Canada has increased proportionately, being 116,557 in 1916 and 191,518 in 1917.

—

Business Improves in Southeast

DETROIT, March 26—Manufacturers report good business in the southeast. Sales likewise are growing in the Middle West, New England and New York.

Cadillac is shipping limousines only to Ohio, Indiana, Michigan, and parts of Illinois. The cars are driven to Chicago and loaded there for shipments to western points. There is a great demand for cars in Canada, the Saxon company finds; orders for 5 carloads having been received from Toronto alone. Due to the heavy snows, Canada could not obtain cars, and is now feeling the shortage.

Ninety per cent of the cars made by the Paige-Detroit company are being driven away. Some have gone as far as Fargo, N. D., and Denver.

—

"2½-Cent Motor Fuel" Costs More than Gasoline

NEW YORK, March 22—The claim of Dr. Louis Clement, a Scandinavian experimenter, that he could produce a motor fuel costing from 2½ to 8 cents a gallon, was disproved recently at a test conducted before a group of chemists. According to reports, Dr. Clement used about 5 lbs. of naphtha flakes, half a gallon of benzine, several ounces of saccharine, some bicarbonate of soda, potassium chlorate, a small bag of alum, 3 gal. of wood alcohol, several ounces of oil of cedar, one ounce of sulphuric acid, 2 bags of talcum powder and about 15 quarts of kerosene. Produced with these ingredients, the chemists estimate that the motor fuel would cost more than 40 cents a gallon.

—

New Used Car Report Out

CHICAGO, March 27—The Used Car Report put out by the Chicago Automobile Trade Assn. has been issued in its sixteenth edition in a new form. The contents are printed as a filler for a stiff board binder. When each of the quarterly reports is received, the user is requested to take out the old filler, send it back to Chicago, and insert his new filler. This provides a better cover, makes the book lighter in weight and facilitates the work in various other ways. Recently there have been added to the book the American Six, Brewster, Comet, Doble, Holmes, Jones, Maibohm and Pan-American.

—

Mid-Continent Crude Oil Now $2.25

TULSA, OKLA., March 25—The price of Oklahoma and Kansas crude oil has been increased 25 cents a barrel by the Sinclair Oil & Gas Co., making the present price $2.25, the highest ever posted for mid-continent crude oil. It is expected that other companies will also increase their price.

Employment of Women Making Rapid Headway

INDIANAPOLIS, March 26—The employment of women in factories has made considerable headway in Indianapolis within the last few months with firms that formerly employed few, if any, women in the manufacturing or inspection department of the factory.

Wheeler-Schebler has for some time been employing women in the Inspection Department and now has more than 50 women employees. Many of these are sisters and daughters of factory employees. In the departments the women are entirely separated from the men. Rest rooms have been fitted up, and a matron has supervision over all of the women employed.

Satisfactory chairs with suitable backs and foot rests are provided. In the Inspection Department the room has been painted white, which has had a psychological effect on the workers.

An effort is being made to have the girls take more substantial lunches than they have been in the habit of doing and coffee is furnished at 1 cent per cup.

Up to this time Wheeler-Schebler has not engaged women in any department where much physical effort is required. The percentage of women changing their positions is much less than that of men according to the experience of this firm.

—

Advertising a War Time Expense

LONDON, March 25—The British War Government recognizes advertising as a necessary expense even for firms almost entirely engaged in the manufacture of munitions. The British Ministry of Munitions recently stated in the *Manchester Guardian* that no arbitrary rule had been made in reference to the advertising expenses of these establishments which, as the Government expressed it, "are controlled." The statement follows:

"In dealing with such establishments for the purpose of munitions levy, it has been the practice of the Ministry to make full allowance for advertising on a pre-war basis; and while it is possible that cases may arise in connection with contracts with the Ministry in which advertising charges would have to be more or less disregarded owing to the particular contract basis, such charges are in general treated as part of the legitimate establishment charges of the firm. All such cases are dealt with separately on their merits."

—

$1,500,000 Surtax for Massachusetts Motorists

BOSTON, March 22—After a hearing before the Committee of Taxation, which lasted less than half an hour, a subcommittee was appointed to draft a bill for a surtax of $1,500,000 to be collected from Massachusetts motorists. State Senator Gifford, in introducing the measure, said flatly that this was the easiest way to get the money needed, as all passenger car owners are listed. The measure calls for a tax, in addition to present fees, of $5 for owners now paying a $15 fee; $10 for those paying more; $2.50 a ton for trucks; $2 for operators and drivers, and $5 for dealers' cars.

—

Monthly Labor Surveys for War Industries

WASHINGTON, March 23 — The United States Public Service Reserve is making a month to month survey of the actual labor conditions in war industries to learn the full strength of American labor applied to war purposes. More than 500 plants now send monthly labor-status reports to the Reserve and it is expected that in the course of 60 days 2000 plants will make them. These reports act as a labor barometer, enabling the Department of Labor not only to prevent serious shortages, but also to meet promptly the new demands for labor which follow rapid expansion of production.

—

Truck Convoy For Overseas

LIMA, OHIO, March 25—The first convoy of U. S. A. standardized war trucks comprising thirty-three of the standardized trucks left Lima this afternoon en route for an eastern seaboard. This is the first convoy of the standardized trucks to travel overland bound for overseas duty and marks the beginning of huge production of the trucks. Complete sets of parts are now in hand in assembly plants for more than 500 of the class B standardized trucks.

Albert Guyot, Racer, Now Consulting Engineer

PARIS, Feb. 26—Albert Guyot, winner of third prize on a French Delage in the 1914 Indianapolis race, has been discharged from the army as the result of injuries received while on active service as an airplane pilot, and has entered into partnership with N. Causan, as a firm of consulting engineers. Engineer Causan has a reputation as designer of high-efficiency racing motors, having produced successful boat and car motors for Delage, Panhard-Levassor and Despujols. Recently Causan returned from America, where he had spent a couple of years, part of that time being with the Chalmers company. Causan and Guyot are particularly interested in racing and aviation motor developments. Their business address in Paris is 81 Rue Laugier.

—

Regulations for Exports to Sweden and Greece

WASHINGTON, March 25—The War Trade Board has issued new regulations for licensing shipments to Sweden and Greece. In the case of Sweden, a handelskommission, or import certificate, must be obtained from the Swedish Government before application for export can be made to the Bureau of Exports. In the case of both countries the application for export is sent to the War Trade Board's representative abroad, and as soon as a decision is reached as to the advisability of the shipment the applicant will be advised.

—

Survey of War Industries Locations

WASHINGTON, March 25—The War Industries Board is making an extensive survey for the location of war industries. This may result in the transfer of many government contracts from the congested Eastern industrial centers to the West and the South, where factories are working under less pressure, have less difficulty with labor and enjoy better transportation facilities. Many contracts will expire April 1, and it is likely that Eastern manufacturers will not secure renewals where the contract can be placed in the West or in the South.

Calendar

ASSOCIATIONS

April 15-19—Little Rock, Ark., United States Good Roads Assn. Sixth Annual Session.

June 5-12—Hot Springs, Va., National Assn. Automobile & Accessory Jobbers.

June 17-19—Dayton, O., Society Automotive Engineers, Annual Midsummer Session.

SHOWS

Mar. 25-30—Rochester, N. Y., Tenth Annual. Rochester Auto. Trades Assn., Exposition Park. C. A. Simmons, Mgr.

Mar. 25-30 — Bridgeport, Conn., Fourth Regiment Conn. Home Guard State Armory and Casino. B. B. Steiber, Mgr.

Mar. 27-29—Fort Fairfield, Me., Reed's Garage. R. F. Reed, Mgr.

Mar. 30-April 6—Hartford, Conn., Eleventh Annual, Hartford Automobile Dealers' Assn., Inc. State Armory. B. F. Smith, Mgr.

Mar. 30-Apr. 6 — Atlantic City, N. J., Second Annual, Garden Pier. S. W. Megill, Mgr.

Mar. 30-Apr. 6—Chicago, Ill., Second Annual Chicago Used Show. Chicago Auto. Trade Assn. Coliseum.

Apr. 1-6—York, Pa., York Auto Dealers' Assn. T. F. Feiffer, Mgr.

April 3-6—Battle Creek, Mich. Second Annual. W. A. Donaldson, Mgr.

April 3-6 — Ogdensburg, N. Y. Second Annual, State Armory.

April 6-13 — Green Bay, Wis., Brown County Automobile Trade Assn.

April 6-13 — Red Bank, N. J., Monmouth County Auto. Dealers' Assn., Armory. E. C. Von Kattengell, Mgr.

April 8-13—Reading, Pa., Reading Auto Trade Assn.

Apr. 9-13—Stockton, Cal., Third Annual San Joaquin Auto Trade Assn. Samuel S. Cohn, Mgr.

Apr. 16-20 — Deadwood, S. D. City Auditorium.

Apr. 17-19—Davis, Cal., Tractor Demonstration. University of California.

Apr. 17-20—Calumet, Mich., Upper Peninsular Show, Copper County Automobile Dealers & Garage Owners' Assn., Coliseum.

May 3-7 — Lima, Ohio, Ohio State Automobile Assn.

Sept. 23-28 — Chicago, National Accessory Show for Fords, Coliseum.

ENGINEERING

June 26-28 — Buffalo, N. Y. American Society of Heating and Ventilating Engineers.

Sept. 2 — Cripple Creek, Colo. American Institute of Mining Engineers.